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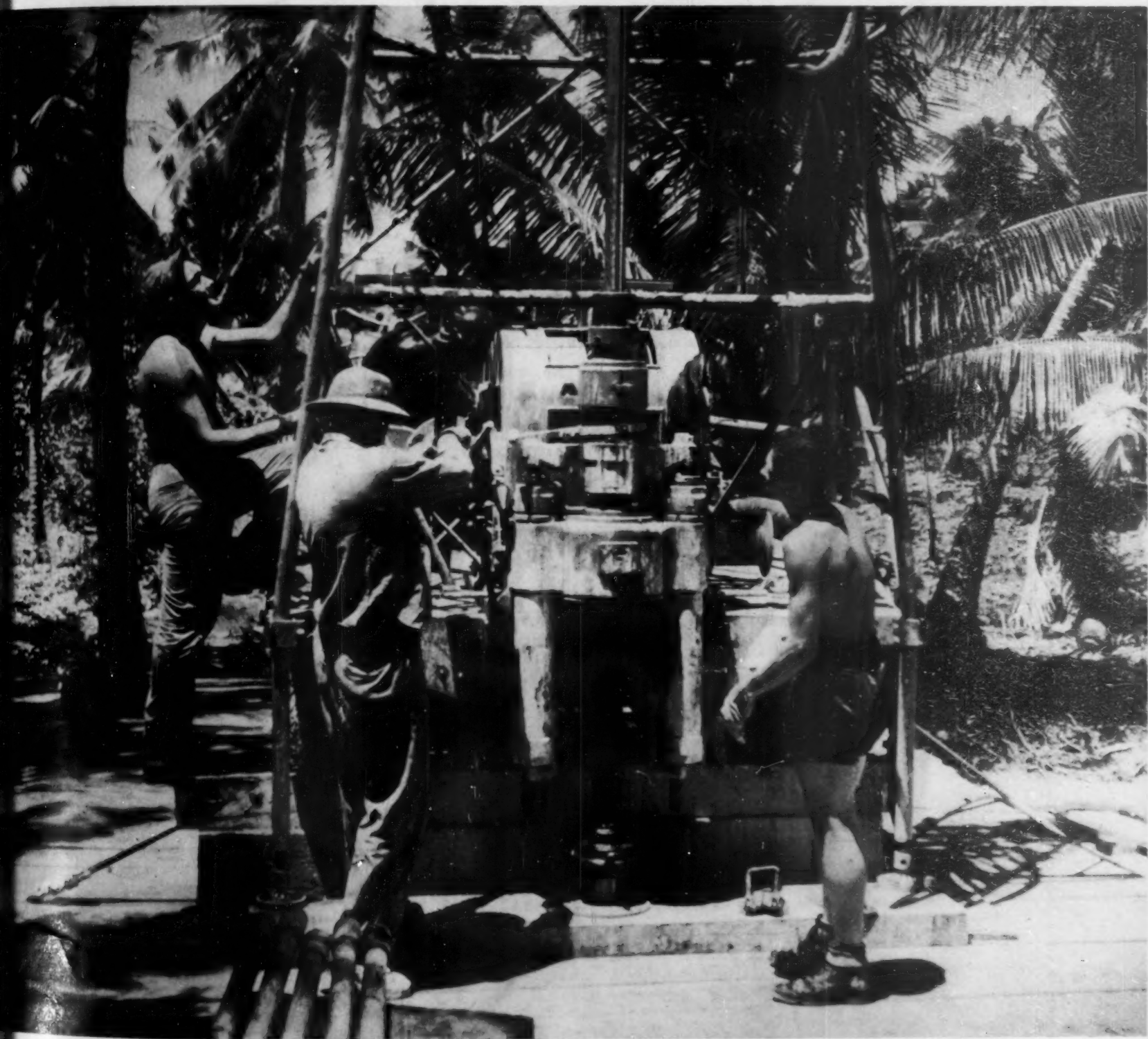
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VOL. 10 NO. 2785

January 1948

Science

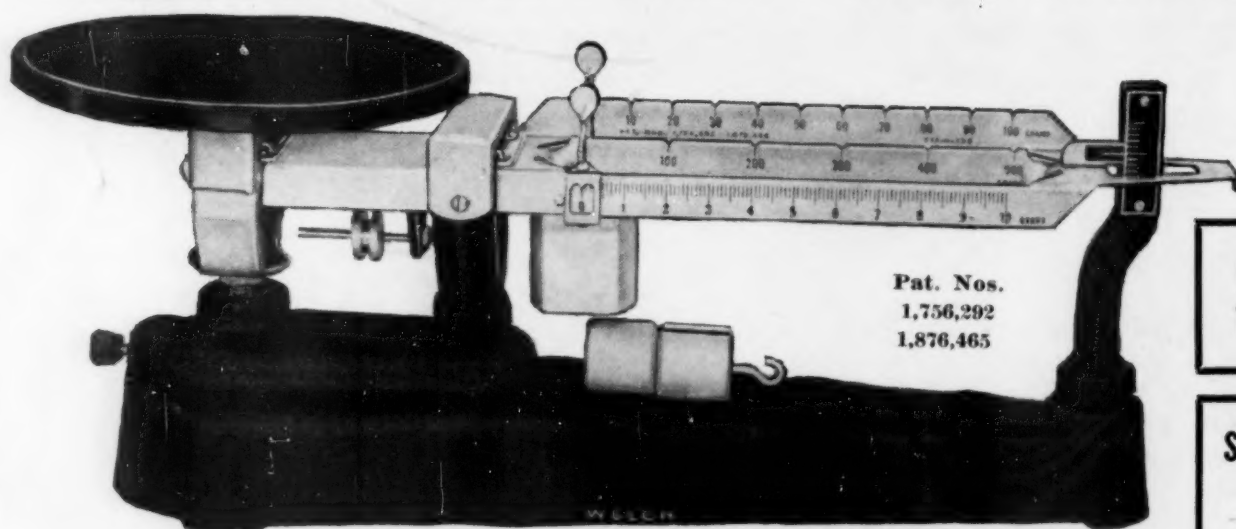


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Vol. 107 No. 2768 Friday, January 16, 1948

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(Cover photo by J. I. Tracey.)

Science, a weekly journal, is published each Friday by the American Association for the Advancement of Science at James F. McCarthy, Successor to The Science Press Printing Company, Lancaster, Pa. Founded in 1880, it has been since 1900 the official publication of the AAAS. Editorial and Advertising Offices, 1515 Massachusetts Avenue, N.W., Washington 5, D. C. Telephone, EXecutive 0000 or 0061. Cable address, SCIMAG, Washington, D. C. Entered as second-class matter January 17, 1947, at the postoffice at Baltimore, Maryland, under the act of March 3, 1879. Application for transfer to the postoffice at Lancaster, Pennsylvania, pending.

Articles offered for publication should be sent to the Editor. The AAAS assumes no responsibility for the opinions expressed by contributors. Membership correspondence for the AAAS should be sent to the Administrative Secretary.

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Drilling on Bikini Atoll, Marshall Islands

H. S. Ladd and J. I. Tracey
U. S. Geological Survey, Washington, D. C.

G. G. Lill
Office of Naval Research

DURING a resurvey of Bikini Atoll (Operation Crossroads) carried out during the summer of 1947, five holes totaling 4,510 feet were drilled on Bikini Island (Fig. 1). One of these (No. 2B) was carried to 2,556 feet—the deepest hole yet drilled on a Pacific coral island. No materials other than calcareous sediments were encountered, and most of these were unconsolidated or very poorly cemented. Tertiary rocks have been identified from a depth of 925–935 feet, but the top of the system may lie considerably higher. A brief description of drilling operations, a preliminary statement of results, and suggestions for additional work are given below.

DRILLING OPERATIONS

All drilling equipment and drilling crews were furnished by the Geo. E. Failing Supply Company under contract with the Navy Department. The drill was the "1500 Holemaster" rotary type, mounted on a truck and complete with all necessary tools and equipment, including about 2,500 feet of drill stem. Rock bits were used for straight drilling and hard metal bits for coring. After setting 6-inch surface casing, the holes were continued with 5½-inch bits. In the deepest hole (No. 2B), 4-inch casing was set to a depth of 804 feet, the remainder of the hole being drilled with a 2½-inch rock bit. Salt water was used with salt-water mud at the beginning of the operation but proved unsatisfactory. During the drilling of the deep hole, fresh water and fresh-water mud were substituted.

V. C. Mickle, assisted by Emmett Alexander, was in

This paper, which presents results of research carried out for the Bureau of Ships and the Office of Naval Research, Navy Department, in cooperation with the Office of the Chief of Engineers, Department of the Army, is published by permission of the Director, U. S. Geological Survey.

Expenses of the drilling were supported by the Bureau of Ships and formed a part of the geological work of the Bikini Scientific Resurvey. The scientific work was supported by funds provided by the Office of Naval Research and the Military Intelligence Division, Office of the Chief of Engineers. The 1947 operation was carried out under the leadership of Capt. C. L. Engleman, Project Officer. The writers wish to thank Capt. Engleman for enthusiastic cooperation in solving the many drilling difficulties as they arose. They also are indebted to Cdr. Roger Revelle, head of the Geophysics Branch, Office of Naval Research, for encouragement and support in planning and carrying out the entire program.

SCIENCE, January 16, 1948

charge of two drilling crews of three each, and the drill was operated continuously in 12-hour shifts. A geologist was on duty at all times, and in this work the writers were relieved from time to time by John W. Wells and J. Harlan Johnson. Tanks of fresh water from the *U.S.S. Chilton* and other necessary supplies were furnished by Cdr. John R. Denny and his Construction Battalion Detachment.

As originally outlined, the drilling program called for a series of five holes, three to windward across Bikini Island and its reef, and two to leeward on opposite sides of one of the small southwestern islands. These holes were to be cored continuously to 300 feet and one of them carried by rock bit to 2,500 feet. When the first holes were put down, the core recovery was poor and the consumption of mud so great that

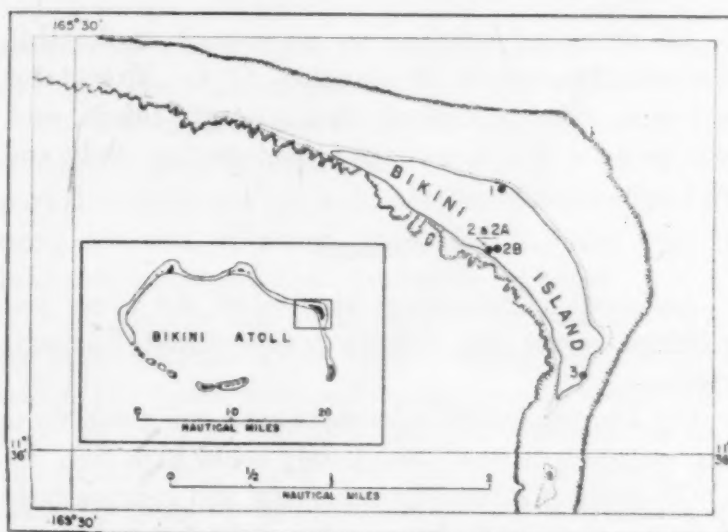


FIG. 1. Map of Bikini Island showing locations of drill holes.

changes seemed in order. The plan to drill on the cavernous reef flat was abandoned, and efforts were concentrated on completing the deep hole with as many core runs as time would permit.

A total of 812 feet was cored with a recovery of 135 feet (16.6%). The recovery was excellent in hard limestone and sometimes very good in the sand; it was poorest in loose or poorly consolidated material in which heads of hard coral were scattered in a matrix of softer sand. Cuttings were recovered at 5- to 10-foot intervals.

There was an appreciable loss of mud during all drilling, and, on occasion, cavities were encountered

that stopped circulation completely. One such cavity was cemented and leakage at lower levels controlled by pouring a variety of absorbent materials, including rice hulls, sawdust, and corn meal, in the hole. Between 2,000 and 2,500 gallons of fresh water were used in each 24-hour period during the drilling of the deepest hole. Exact figures on depths, core recovery, etc. are included in Table 1.

TABLE 1

Hole No.	Depth (ft)	Casing (ft)	Drilling time (hrs)	Footage cored	Core recovery (ft)	Core recovery (%)
1	300	19 (6-inch casing)	46	281	33.5	12
2	190	41 (6-inch casing)	23	153	29.5	19.3
2A	1,346	190 (6-inch casing)	162	271	41.0	15.1
2B	2,556	28 (6-inch casing) 804 (4-inch casing)	190	None	None	None
3	118	6 (6-inch casing)	40	107	31.0	29
Total	4,510	284 (6-inch casing) 804 (4-inch casing)	461	812	135.0	16.6

All cores and cuttings are on deposit at the U.S. National Museum in Washington, D. C. Except for a few samples particularly rich in larger fossils, each will be split into two equal parts, one for study and one to be retained intact.

GEOLOGY

Lithology. Preliminary studies of the cores and cuttings reveal the following generalized lithologic zones:

- (1) Unconsolidated calcareous sand and gravel from the surface to a level immediately below high tide.
- (2) Bedded calcareous sandstone and conglomerate 2 feet or more in thickness at intertidal levels.
- (3) Reef limestone extending to 65-75 feet, mainly sandy and poorly consolidated but in part compact and well cemented, showing reef corals in positions of growth. Occurrences of hard limestone at depths of from 35 to 65 feet suggest that the shallow terraces fringing the existing reef and the lagoon may be continued beneath the island.
- (4) A zone of porous, poorly cemented, white to cream-colored coralliferous limestone with algae and other fossils, extending to about 425 feet. In the interval from 300 feet to the bottom of the zone (and downward at least to 575 feet) many of the corals and mollusks are preserved as molds, suggesting that this part of the section was above sea level for an appreciable time following deposition.

(5) A zone between 425 and 725 feet wherein the material grades from a white, poorly consolidated limestone to a tan, very porous sand with a variety of fragmentary fossils.

(6) A zone between 725 and 1,100 feet in which the material is sandy and poorly consolidated but shows layers containing well-preserved shallow-water Foraminifera, corals, and mollusks.

(7) A zone of fairly firm limestone from 1,100 to 1,135 feet.

(8) A section of medium to fine tan calcareous sand with a few identifiable fossils, extending from about 1,135 to 2,556 feet.

Very little magnesium carbonate is present in the samples analyzed to date. One sample from a beach sandstone core contains 8.27% magnesium carbonate, but 11 other samples at intervals down to 2,500 feet contain only .24-3.46%.

Age. Fossils are abundant in many of the cores and cuttings. The Foraminifera are now being studied by W. S. Cole; corals, by J. W. Wells; mollusks, by H. S. Ladd; and algae, by J. H. Johnson. The top of the Tertiary section has not yet been determined. Tertiary fossils have been identified from a depth of 930 feet, but the contact may lie above 725 feet and possibly as high as the 425-foot level.

Well-preserved upper Tertiary reef corals and mollusks are present in 2½ feet of sandy core recovered from a depth of 925-935½ feet. Many differ from the species now living in the Marshall Islands, some of them being new and others identical with forms occurring in the late Tertiary of the East Indies. A number of the mollusk shells show original luster and traces of color pattern. Foraminifera and echinoid fragments from this interval are not diagnostic with regard to age, but the entire assemblage suggests a depth considerably shallower than that where it is now found. Although many of the fossils show evidence of wear, it appears unlikely that they were transported appreciable distances either horizontally or vertically.

Diagnostic genera of Foraminifera indicating a Tertiary age have been identified from several levels below 1,020 feet. The section from 1,790 feet to the bottom of the hole is definitely lower Miocene, probably to be correlated with Tertiary *e* of the East Indian section.

Geophysical Observations. Seismic investigations made in 1946 indicated that Bikini is underlain at depths of 6,000-13,000 feet by hard material, presumably igneous rock having a seismic velocity of 17,000 feet/second (1). This basement surface is irregular. After the drilling of the deep hole in 1947, the Geotechnical Corporation made seismic velocity tests to obtain reliable data for the interpretation of the earlier records. A total of 72 seismic vertical

velocity measurements were made at intervals between 1,820 and 50 feet. A preliminary review of these data shows a break at a depth of about 800 feet. Above this level there are numerous intercalated bands with high velocities. The break at 800 feet correlates reasonably well with the geological data already presented. Below 800 feet the velocity increases relatively steadily with depth to a maximum of approximately 11,000 feet/second. It would appear, therefore, that the entire section above the basement—a section 1-2 miles in thickness—is sedimentary in nature, probably composed of calcareous sediments not unlike those found in the lower part of the deep hole.

COMPARISON WITH OTHER DRILL HOLES

Funafuti Atoll, Ellice Islands. In 1896-98 the British cored to a depth of 1,114 feet on the seaward margin of Funafuti Island 500 feet from the reef edge (Fig. 2). They obtained an over-all core recovery of

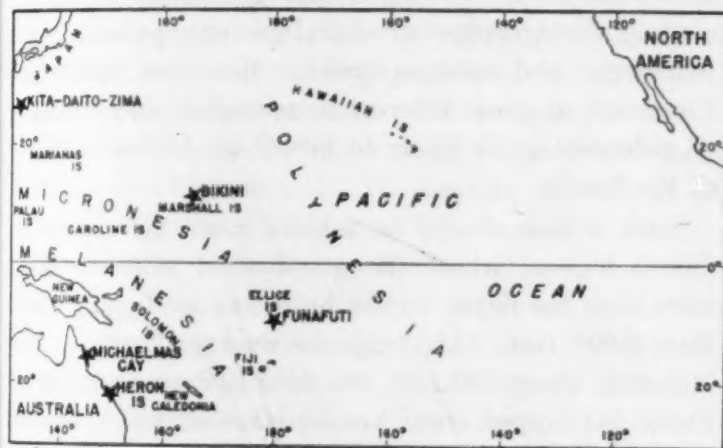


FIG. 2. Map of a part of the Pacific showing locations of drill holes on coral islands.

34% and described their findings in a detailed report (8). The section from 0 to 637 feet consisted of porous, friable limestone containing corals, calcareous algae, mollusks, and Foraminifera. From 637 to 748 feet was a white, soft and earthy dolomitic limestone with fossil remains less conspicuous. From 748 to 1,114 feet the rock was a hard and compact dolomitic limestone, 85% of which was recovered as a solid rock core. No fossils other than Recent species were reported, and shallow-water forms only were found.

Magnesium carbonate was generally 1-5% to a depth of 637 feet, with the exception of a maximum of 16% between 15 and 25 feet. Below 637 feet, in the white, earthy limestone, the magnesium carbonate rose rapidly to a maximum of 40%, this being maintained to the bottom of the hole with the exception of two intervals, 819-875 feet and 1,050-1,097 feet, where dolomitization was less. The lower third of the Funafuti boring thus differs radically from that of Bikini in age, induration, and chemical composition.

Kita-Daito-Zima. In 1934-36 the Japanese cored a hole to a depth of 431.67 meters (1,416 feet) on Kita-Daito-Zima (North Borodino), a small island lying south of Japan and to the east of Okinawa (Fig. 2). According to figures given by Endo (3), a core recovery of about 28% was obtained above 240 meters; in the lower part of the hole Sugiyama states (7) that recovery was lower but averaged above 10%. Study of the cores by Hanzawa (4) revealed that down to a depth of 103.49 meters (340 feet) there was cavernous, indurated, dolomitic limestone, containing reef-building corals, calcareous algae, and Foraminifera; from 103.49 to 116.41 meters (340-382 feet), grayish-blue calcareous mud with some limestone; from 116.41 to 209.26 meters (382-687 feet), white granular limestone; from 209.26 to 394.98 meters (687-1,296 feet), coarse-grained calcareous sand; and from 394.98 meters (1,296 feet) to the bottom of the hole at 431.67 meters (1,416 feet), fine-grained calcareous sand. From his studies of the Foraminifera, Hanzawa refers the material above 103.49 meters to the "Plio-Pleistocene," the interval 103.49-394.98 meters to the Aquitanian (lower Miocene), and the lowest zone (below 394.98 meters) to the Chattian (upper Oligocene). Dolomitization was high in the upper levels, ranging from 78.87 to 90.45% dolomite for the interval 0-103.49 meters. Below this interval the dolomite content dropped abruptly to 1.07-6%, with a few intervals having a much higher percentage (41.31-87.56%).

The dolomitic limestones of the upper part of the section in the Kita-Daito-Zima hole have no counterpart in Bikini, but the section below 209.26 meters is much like that of Bikini, both sections being unconsolidated, nonmagnesian, foraminiferal sands.

Great Barrier Reef. In connection with the comprehensive studies of the Great Barrier Reef of Australia, two holes were put down, one on Michaelmas Cay, the other on Heron Island (6). These sites are 700 miles apart, Michaelmas Cay being at about the central point in the length of the reef and Heron Island at the southern end (Fig. 2). The Michaelmas Cay hole, lying 14 miles from the seaward margin of the barrier, was carried to a depth of 600 feet; the Heron Island hole, 10 miles from the reef edge, was drilled to 732 feet. In each hole the material encountered for practically the entire depth was loosely coherent, and none of it was dolomitized. The northern hole passed through 378 feet of coralliferous limestone into quartz-foraminiferal sand; in the southern hole the calcareous material extended to 506 feet before entering the sand. Neither hole reached the basement rock. Core recovery was poor, a small fraction of 1% being recovered below 20 feet. It was concluded that the limestone section was accumulated at depths never greater than 25 or 30 fathoms. Mollusks were found

in the Heron Island hole to depths of 696 feet, all apparently being littoral species. Some of the foraminiferal assemblages, however, both in the calcareous section and in the sands below, consisted of worn and broken larger, shallow-water species mixed with well-preserved, smaller, deeper-water species. No extinct species were found, and it was concluded that the entire section is Recent in age.

The limestone section is similar in many ways to that of Bikini, but detailed comparison has not yet been made.

Borneo Shelf. Kuenen (5) has reported briefly on two holes recently drilled on Marathea, described as a horseshoe-shaped elevated atoll, 30 by 7-8 kilometers, lying northeast of Borneo near the seaward edge of the shelf that extends from Borneo to the Celebes Sea (shelf close to island lies at a depth of 270 meters). Highest point on the island is 110 meters; the lagoon is 5-10 meters deep. The drilling was on an islet 2-2½ kilometers inside the outer margin of Marathea and presumably close to sea level. The first hole was alternately cored and drilled to a depth of 261 meters (856 feet); the second was cored and drilled to 373 meters (1,224 feet), then cored continuously to 429 meters (1,407 feet). A core recovery of 19% is recorded from 51.25 meters (168 feet) of sampling from the 250- to 368-meter interval. Coral limestone alternating with a mixture of pieces of coral limestone and coral sand was found to 189 meters (620 feet); from that level to 261 meters (856 feet) there was no hard limestone but mainly cemented reef detritus and soft, marly limestone merging into an olive-green limy marl. Below 260 meters (853 feet) was an irregular alternation of coral limestone detritus and soft, amorphous, nonfossiliferous limestone. No evidence is given of the content of magnesium carbonate, but preliminary studies of some of the finer samples show a lime content of 83-98%. The age of the sediments penetrated is not stated. The section, except for the greenish marl reported in the first hole, is not unlike that found on Bikini. As Kuenen points out, had the hole been carried 100 meters deeper, the Borneo platform would probably have been encountered and the maximum thickness of "coral growth" in that area would thus have been established.

SUGGESTIONS FOR ADDITIONAL WORK

The establishment of a thick Tertiary section beneath Bikini is very significant in connection with the geologic history of the Pacific Basin,¹ but of even

¹ The discovery of such a section was not entirely unexpected, as H. Yabe and R. Aoki (*Jap. J. Geol. Geogr.*, 1922, 1, 40-44, Pl. 4) had previously found pellets of limestone containing *Lepidocyclina* in a Recent reef conglomerate on Jaluit, an atoll lying southeast of Bikini in the Marshall Group.

greater interest are the indications that the sedimentary section continues downward for many thousands of feet. The determination of the geological time-span of this unknown section and the environments of deposition which it records should reveal much about the evolution of the Pacific Ocean.

The character of the unknown basement rock is also a matter of prime importance. It may be a basaltic mound, but this is not certain. Other possibilities involving the fundamental structure of the Pacific should be considered. In this connection it should be noted that the atolls of the Marshall Islands, including Bikini, are aligned in two arc-like series. In this area also there are numerous flat-topped sea mounts² which rise to levels 700-900 fathoms below the surface. One of these structures adjoins Bikini as a terrace-like feature extending northwestward for 20 miles (2).

It is believed that the drilling of a hole to a depth of 8,000-10,000 feet and subsequent exhaustive studies of cores from such a hole would result in significant contributions in several diverse geological fields, including stratigraphy, structural geology, paleontology, petrology, and tectonophysics. Moreover, much information of great interest to zoologists and students of paleoecology is likely to be obtained from a study of the fossils.

Such a hole should be located near the center of Bikini lagoon, where the geophysical evidence indicates that the depth to the basement is slightly more than 8,000 feet. Although the average depth of the lagoon is about 180 feet, the floor is dotted with relatively flat-topped coral knolls, some of which rise to within 12 feet of mean sea level. The tops of these knolls are about 100 feet in diameter and are covered with a rich growth of corals. A substantial foundation for a drilling platform could thus be provided, since a barge could be sunk on such a knoll and a portable drilling rig mounted on top of the barge. Engineers and drillers with whom the plan has been discussed foresee no major difficulties.

References

1. DOBRIN, M. B., SNAVELY, B. L., WHITE, G., BERESFORD, R., and PERKINS, B., JR. *Bull. geol. Soc. Amer.*, 1946, 57, No. 12, Pt. 2, 1189. (Abstract.)
2. EMERY, K. O. *Bull. geol. Soc. Amer.*, 1946, 57, No. 12, Pt. 2, 1191. (Abstract.)
3. ENDO, ROKURO. Method of boring of testing the formation in Kita-Daito-Zima. Publ. Geological and Paleontological Institute, Tohoku Imperial Univ., 1935, No. 14. (Translated by Tadasi Naito.)
4. HANZAWA, SHOSHIRO. Micropaleontological studies of drill cores from a deep well in Kita-Daito-Zima (North Borodino Island). In *Jubilee Publ. in Commemora-*

² These are called guyots by H. H. Hess in a recently published study that gives much information on the form, distribution, and possible origin of such structures in the areas between Hawaii and the Marianas (*Amer. J. Sci.*, 1946, 244, 772-791).

tion of Prof. H. Yabe's 60th Birthday, 1940, Vol. 2, 755-802.

5. KUENEN, PH. H. *Verh. Koninklijke Ned. Akad. Wetenschappen*, 1947, Pt. 43, No. 3, 1-35.
6. RICHARDS, H. C., and HILL, DOROTHY. Great Barrier Reef bores, 1926 and 1937: descriptions, analyses and interpretations. Reports of the Great Barrier Reef Committee, Vol. 5, 1-122. Brisbane, Australia: Government Printer, 1942. (Includes appendix on Foraminifera of Heron Island hole by Joseph A. Cushman and one on mollusks by Tom Iredale.)

7. SUGIYAMA, TOSHIO. On the second boring at Kita-Daito-Zima. Publ. Geological and Paleontological Institute, Tohoku Imperial Univ., 1936, No. 25. (Translation.)
8. ———. The atoll of Funafuti. Report of the Coral Reef Committee of the Royal Society, London, 1904, 1-428.

Association Affairs

Officers for 1948

At the recent annual meeting of the Association in Chicago, E. C. Stakman, of the University of Minnesota, St. Paul, was named president-elect. The two newly-elected members of the Executive Committee, replacing Dr. Stakman and Arthur H. Compton, are Roger Adams, of the University of Illinois, and Edwin B. Fred, president of the University of Wisconsin. Those elected vice-presidents of the American Association for the Advancement of Science are: Section A (Mathematics), R. L. Wilder, University of Michigan; Section B (Physics), F. W. Loomis, University of Illinois; Section C (Chemistry), Lee Irvin Smith, University of Minnesota; Section D (Astronomy), Alfred H. Joy, Mount Wilson Observatory; Section E (Geology and Geography), Henry R. Aldrich, Geological Society; Section F (Zoology), Alfred S. Romer, Harvard University; Section G (Botanical Sciences), E. N. Transeau, Ohio State University; Section H (Anthropology), Wilton M. Krogman, University of Pennsylvania; Section I (Psychology), Edwin R. Guthrie, University of Washington, Seattle; Section K (Social and Economic Sciences), Talcott Parsons, Harvard University; Section L (History and Philosophy of Science), Alexander Pogo, Harvard University; Section M (Engineering), William R. Osgood, U. S. Navy, Washington; Section N (Medical Sciences), Shields Warren, Harvard Medical School; Section O (Agriculture), H. K. Hayes, University of Minnesota; and Section Q (Education), Francis D. Curtis, University of Michigan.

Section on Geology and Geography (E)

The program of Section E at the Chicago meeting was made up of a symposium on "Problems of Mississippian Stratigraphy and Correlation," organized by J. Marvin Weller, which met for morning and afternoon sessions on Friday, December 26, and a symposium on "Methods of Ground-Water Investigation," organized by E. J. Schaefer, which met for two sessions on Saturday, December 27. A joint session with Section D (Astronomy), a symposium on "Origin

of the Earth," was held on Saturday afternoon, December 27 (to be reported upon under Section D).

Geologists from many parts of the country working on Mississippian problems were present to describe the results of their work and take part in the discussions. In his introduction to the Mississippian Symposium, Prof. Weller, of the University of Chicago, indicated the general problems to be considered. The papers are to be published as a special issue of the *Journal of Geology*. In discussing the status of Mississippian stratigraphic knowledge in the Appalachian region, B. N. Cooper, of Blacksburg, Virginia, emphasized the need for detailed studies. P. B. Stockdale, of the University of Tennessee, discussed Mississippian stratigraphy of the southern Appalachians, including results of recent facies studies and problems of defining the Mississippian-Pennsylvanian boundary. D. H. Swann, of the Illinois Geological Survey, presented his and co-author Elwood Atherton's work on subsurface studies of Chester strata in the Illinois basin. L. R. Laudon, of the University of Kansas, described studies indicating that the Osage-Meramee boundary constitutes a major break throughout the Upper Mississippi Valley and in a large area to the west and northwest. E. L. Selk, Oklahoma City, took up the problem of the "Mayes" in Oklahoma. There was vigorous discussion of each of these papers.

During Part II of the Mississippian Symposium, on the afternoon of December 27, J. S. Williams, of the U. S. Geological Survey, Washington, D. C., discussed Mississippian-Pennsylvanian boundary problems in the Rocky Mountain region, and E. C. Reed, of the University of Nebraska, presented subsurface data from Nebraska and surrounding states which indicate that the Mississippian seas were not continuous between the mid-continent region and the northern Rocky Mountain region. Paleontological problems of the Mississippian were taken up in four papers: A. K. Miller, University of Iowa, described Mississippian ammonoid zones; C. A. Arnold, University of Michigan, the Mississippian flora; and C. L. Cooper,

USGS, Washington, D. C., microfossils of the Mississippian. R. C. Moore, of the Virginia Agricultural Experiment Station, Blackburn, brought out the parallelism and differences in American and European faunas of the Mississippian. Most of these papers brought forth animated discussion.

On Saturday morning, December 27, the symposium on "Methods of Ground-Water Investigation" was introduced by E. J. Schaefer, USGS, Columbus, Ohio. F. C. Foley, USGS, Madison, Wisconsin, discussed development of ground water for military use in the Mediterranean theatres, 1942-45. Among other things, he described wells drilled in volcanic craters. Leland Horberg, of The University of Chicago, described the mapping of subsurface Pleistocene stratigraphy and the determination of buried valleys in Illinois, some of which serve as important sources of ground water. M. B. Buhle, Illinois Geological Survey, Urbana, in a joint paper with C. A. Bays, discussed the electrical-resistivity method of exploration for ground water. V. C. Fishel, of the USGS, Indianapolis, summarized the methods used in ground-water investigations in Kansas, and S. E. Hargis, Jr., of Harvard University, in a joint paper with H. G. Hershey and W. E. Hole, described the methods of ground-water investigation in Iowa.

The Saturday afternoon session, Part II of the Ground-Water Symposium, dealt with problems in various states. F. H. Klaer, Jr., USGS, Indianapolis, described the usefulness of soil maps in mapping glacial geology and in ground-water investigations in Indiana; K. E. Anderson, Missouri Geological Survey, Rolla, methods of tracing sources of well contamination in Missouri, showing also the close relationship between geological conditions and probability of contamination; and J. G. Ferris, USGS, Lansing, Michigan, examples of hydraulic analyses which provided geophysical and geological information. M. I. Rorabaugh, USGS, Louisville, Kentucky, reported on studies of infiltration from the Ohio River near Louisville into the glacial aquifers and demonstrated the proportion and amount of river water entering the aquifers. D. W. VanTuyl, USGS, Columbus, Ohio, summarized the methods of investigation of a glacial aquifer near Canton, Ohio, in which stream flow duration curves, correlation of stream flow with pumping, and long-time well records combine to give a figure for safe yield from the aquifer. All papers were discussed and many of them by several participants.

The address of J. L. Rich, University of Cincinnati, retiring vice-president for 1947, on "Goals and Trends in Geological and Geographical Research" was delivered at 2:00 P.M. on December 27. Dr. Rich, in discussing the various motives for research, included the fear motive. He pointed out the danger to universi-

ties of secret research, and many disadvantages to universities resulting from their conducting government-sponsored research. He analyzed the problems of financing research, including the very pressing current problem of lessening returns from endowments.

The meetings of the Section were well attended, and the joint session with Section D overtaxed the capacity of the room provided for it. A local committee of which Leland Horberg was chairman, provided for assistance in many matters. (GEORGE W. WHITE, Secretary.)

Section on Medical Sciences, Subsection on Pharmacy (Np)

The Subsection held three sessions during the Chicago meeting. The sessions were well attended by representatives of the pharmaceutical industry, departments of pharmacology in medical schools, and representatives from the various areas of science in schools of pharmacy.

H. W. Youngken and Wm. E. Hassen, Jr., of the Massachusetts College of Pharmacy, Boston, reported that the camphor basil, *Ocimum kilimandscharicum*, a shrubby plant native to Kenya, British East Africa, has been grown successfully as an annual in the Boston area. A detailed description of the cultivated plants grown in the Medicinal Plant Garden was given. The dried leaves and flowering tops harvested in late October yielded an average of 2.5% of oil and 2.54% of camphor, the latter similar to the camphor from the camphor laurel of Japan and China.

E. R. Kirch, O. Bergeim, J. Kleinberg, and S. James, from the University of Illinois, Chicago, discussed experiments carried out under conditions of artificial gastric digestion to show the influence of various foods on the reduction of iron. It was found that fresh fruits and vegetables reduced iron as much as 77-98%, largely due to the ascorbic acid content. Egg white, meat, and bread reduced iron to the extent of 25-40%, while milk and egg yolk gave practically no reduction. It is believed in general that the iron utilized by the animal organism has to be in the reduced or ferrous state in order that it may be utilized and absorbed to a maximum.

From the Smith, Kline & French Laboratories, Philadelphia, came a report by R. H. Blythe, J. J. Gulesich, and H. L. Tuthill which described new and modified *in vitro* tests based on physicochemical principles devised for the evaluation of hydrophilic laxatives. These tests measure swelling, water uptake, and water retention in artificial gastric and intestinal media. *In vivo* conditions are further simulated by a novel use of Carbowax as an osmotic agent. In this test, the gel formed by allowing the substance to swell

in artificial intestinal fluid is subjected to the pull of a 30% solution of Carbowax "4000" through a "600"-grade cellophane membrane. This osmotic effect was selected as giving an indication of hydrophilic properties of the agent under the physiological conditions which exist in the colon. The tests were applied to commercial preparations of karaya and psyllium and to the synthetics, methylcellulose and sodium carboxymethylcellulose. In addition to having the advantages of greater uniformity and stability, the cellulose derivatives were found to be generally superior to the gums in hydrophilic properties.

C. C. Pfeiffer, of the University of Illinois at Chicago, gave the result of work in which he attempted to answer why a particular type of chemical structure or, more important, why unrelated types, have the same specific pharmacological action on particular types of reactive cells. Previous hypotheses based on the known ring systems of organic chemistry have been inadequate. Greater correlation is obtained by modeling the formulas in three dimensions, determining the active prosthetic groups and the critical or optimal interprosthetic distance lineally. Atomic model measurements of acetylcholine and its aliphatic homologues are in accord with the postulate that three receptors on the cell surface are activated by a double oxygen prosthetic group and a methyl on nitrogen prosthetic group at an interprosthetic distance of approximately 5 Å. The nature of the oxygen prosthetic groups may be ester, ketone, ether, or hydroxyl. The closed ring structure of pilocarpine, arecoline, neostigmin, and physostigmin have these three prosthetic groups at approximately the same interprosthetic distance as in acetylcholine. Potency of the quaternary analogues of neostigmin may be correlated with the optimal interprosthetic distance. Potent blocking molecules which are close analogues of atropine have an identical spacing of the three prosthetic groups contained in a large umbrella molecule which, in some unknown manner, blocks the receptors on the cell and perhaps adjacent receptor groupings.

Researches on the new rodenticide known as Castrix were described by K. P. DuBois, of The University of Chicago. This investigation has shown that Castrix is about 5 times more toxic to rats than the wartime discoveries known as 1080 and ANTU. It is readily acceptable to rats and highly toxic when offered at a concentration of 1% in the diet. Castrix produces convulsions and death in about 30 minutes after lethal doses are eaten. Sodium pentobarbital (Nembutal) was found to be a very effective antidote for Castrix poisoning.

Particular interest was evidenced in a series of papers on the use of radioactive tracer compounds. John E. Christian, of Purdue University, pointed out

that radioactive elements have possibilities for direct application in therapeutics, but that their greatest interest in pharmaceutical research is as tracer elements. Because a radioactive isotope of an element behaves identically with other isotopes of that element in all chemical and physiological properties, it labels without question the particular atoms one wishes to trace. In other words, the labeled atoms are specific for tracing any element. The extreme dilutions in which it is possible to trace such tagged atoms makes it possible to undertake studies hitherto impossible. For example, one may study and determine accurately the rate of absorption of certain substances and the degree of irritation on the skin or mucous membranes, the time and rate of disintegration of enteric coated tablets, the distribution of drugs into certain organs and tissues, the rates of excretion, and the route of excretion. This new tool should make it possible greatly to extend our knowledge of the mechanism of drug action, and from that knowledge we should be able to devise better drugs.

The removal of calcium and phosphorus from teeth by mouth washes, fruit juices, and similar substances has received considerable attention in the scientific press during the last few years.

A. E. Jarvis, of Pitman-Moore and Company, Indianapolis, and L. D. Edwards, J. E. Christian, and G. L. Jenkins, of Purdue, showed that when a rat was injected with radioactive phosphorus, the rat's teeth became radioactive. The effect of various substances on the removal of the radioactive phosphorus from the rat's tooth was then studied. It was revealed that the pH of the solution of a mouth wash or fruit juice has little effect upon phosphorus depletion of the teeth. Distilled water removed much more phosphorus than did ordinary tap water or the usual mouth washes. Lemon juice was found to be the most active of all the substances tested in removing phosphorus from teeth.

R. K. Thoms, J. E. Christian, and L. D. Edwards reported that they had determined the residues of applied phospholipids and sodium *n*-alkyl sulfates on the rat skin using radioactive tracer substances. They found that this technique evaluated very well the amount of such residues remaining after application in the form of a soap and rinsing with water. In a series of sodium *n*-alkyl sulfates the residues remaining on the skin after rinsing and drying were greatest with those compounds whose chain length was optimum for surface activity, namely, 12 carbon atoms. These investigators found that the amount of phospholipid in a so-called superfatted soap remaining on the skin after application in soap and then washing was almost insignificant. (GLENN L. JENKINS, Chairman.)

NEWS and Notes

C. H. Best, University of Toronto, will deliver the annual Phi Beta Pi Lecture at Baylor University College of Medicine, Houston, Texas, on the evening of March 22. Dr. Best will also spend the remainder of that week as visiting professor in the Department of Physiology.

Lenna Cooper, chief, Department of Nutrition, Montefiore Hospital, New York, and formerly the first dietitian of Battle Creek Sanitarium, and food director of the University of Michigan, received the honorary D.Sc. degree from Drexel Institute of Technology, Philadelphia, at the combined Commencement and Founder's Day exercises December 16.

Nathan Anthony Womack, professor of clinical surgery and surgeon to out-patient clinics, Washington University, and associate surgeon, Barnes General, St. Louis Children's, and St. Louis Maternity Hospitals, has been appointed professor and head, Department of Surgery, College of Medicine, University of Iowa. Dr. Womack will assume his new duties about July 1.

Mildred W. S. Schram, secretary (executive officer) of the International Cancer Research Foundation, now the Donner Foundation, since its organization in June 1932, will resign January 17. Dr. Schram's successor has not yet been appointed.

Alfred Golden, formerly director of Laboratories, Baptise Memorial Hospital, Memphis, Tennessee, became associate professor of pathology, Institute of Pathology, University of Tennessee, Memphis, on November 15.

Charles H. Carpenter, chief, Division of Photography, Chicago Natural History Museum, for 48 years, retired December 31.

G. G. Brown, chairman of the Department of Chemical and Metallur-

gical Engineering, and **Jesse Ormondroyd**, of the Department of Engineering Mechanics, have been granted leaves of absence from the University of Michigan for one year, beginning February 1. During this time Dr. Ormondroyd will serve as coordinator of basic research in the University Department of Engineering Research.

Anders Kvale, chairman of the Department of Geology at the Bergens Museum, Bergen, Norway, from 1939 to 1942, has been appointed visiting associate professor of geology at the University of California, Los Angeles. Dr. Kvale's work has been principally concerned with structural geology and petrology applied to the metamorphic and igneous rocks of Norway.

Richard Brauer, who has been on the faculty of the University of Toronto since 1935, has been appointed professor of mathematics at the University of Michigan. Dr. Brauer is editor of the *American Journal of Mathematics*, associate editor of *Transactions of the American Mathematical Society*, member of the editorial board of *Mathematical Expositions*, and colloquium lecturer of the American Mathematics Society for 1948.

Philip C. Jessup, of Columbia University, **Edgar Erskine Hume**, of the Army Medical Service, and **Wendell Stanley**, Rockefeller Institute for Medical Research, received the degree of Doctor Honoris Causa at the inaugural meeting of the University of Paris at the Sorbonne amphitheater on December 6.

Visitors to U.S.

Augustin Venzano, of the Exact Science Faculty, Buenos Aires, Argentina, who has been visiting this country for a year as a Seagram International Fellow, will return to Argentina as head of the E. R. Squibb Company penicillin plant there, after further training at the Squibb plant at New Brunswick, New Jersey.

M. Ruiz Castaneda, Mexico, D. F., who has charge of the Mexican campaign against brucellosis, recently

visited this country and lectured on brucellosis in Dallas, Texas, Norman, Oklahoma, and Minneapolis, Minnesota. He also participated in the conference of the Committee on Public Health Aspects of Brucellosis of the National Research Council, held in Washington, D. C., November 24 and 25, 1947.

Awards

Theodore von Karman, director, Guggenheim Laboratory of Aeronautics, California Institute of Technology, has been named to receive the John Fritz Medal for 1947, highest engineering honor awarded in this country. Dr. von Karman, a native of Hungary and former director of the Aeronautical Institute at the University of Aachen, has been at Cal-Tech since 1928, and during and since the war has served as consultant on aeronautics to the War Department.

Games Slayter, vice-president in charge of research and development, Owens-Corning Fiberglas Corporation, is to receive the 1948 Industrial Research Institute medal presented for outstanding contributions to the field of industrial research. The medal will be presented February 5 during the winter meeting of the Institute at Rye, New York. The Institute, which includes 93 companies representing various types of industry in this country, cited the recipient for his leadership in developing glass fibers and applying them commercially.

Gioacchino Failla, of the Columbia University College of Physicians and Surgeons, was a recipient of the gold medal of the Radiological Society of North America at the Society's dinner meeting in Boston on December 4.

Fellowships

The American College of Physicians has awarded Research Fellowships in Medicine for the year beginning July 1948 to the following: Charles Gordon Campbell, fellow in cardiology, Vancouver General Hospital, who will study the basic physiology of certain cardiovascular problems in the Department of Physiology, McGill University; Frank Herbert

Gardner, fellow in medicine, Boston City Hospital, who will study the mechanism and clinical application of the osmotic fragility test in the Thorndike Memorial Laboratory; Samuel P. Martin, resident in medicine, Duke University Hospital, who will study bacterial metabolism in the Rockefeller Institute for Medical Research; Peritz Scheinberg, assistant resident in medicine, Duke University Hospital, who will investigate cerebral circulation and peripheral vascular flow in normal and hypertensive persons there; Lutfu Lahut Uzman, assistant, McLean Hospital, Waverley, Massachusetts, will study the isolation and characterization of brain proteins and their role in health, disease, and senescence in the Department of Scientific Research at McLean Hospital; and John Martin Weller, medical resident, Veterans Administration Hospital, Hines, Illinois, who will study ionic patterns of the intracellular fluids and their influence on enzymatic reactions and of acid-base balance in tissues other than skeletal muscle tissues at the Department of Biologic Chemistry, Harvard Medical School.

Applications for the Atkins Research Fellowship in Tropical Agriculture must be filed by March 1, 1948. Established at Harvard University to stimulate interest in tropical agriculture, this research fellowship, carrying a stipend of \$1,500, will enable the fellow to matriculate in the Graduate School of Arts and Sciences, spending a limited amount of time in graduate study at Cambridge and the remainder at the Atkins Garden and Research Laboratory at (Soledad) Cienfuegos, Cuba, for intensive work on a special problem. Details and forms may be obtained from the Chairman of the Committee on Graduate Scholarships, 24 Quincy Street, Cambridge 38, Massachusetts.

Case Institute of Technology again offers 50 General Electric Fellowships for high school and preparatory school teachers of physics from Ohio, Michigan, western Pennsylvania, West Virginia, Kentucky, Indiana, Illinois, and Wisconsin, for a 6-week program of study during the summer of 1948. The program, a

repetition of the successful one held last summer, is designed to acquaint teachers with the recent developments and research in the field of physics. The Fellowships include all tuition fees, room and board, and travel expenses. Courses in the program will be under the supervision of Elmer Hutchisson, dean of the Graduate Division, and will be conducted by Robert S. Shankland, head, Department of Physics; Russell C. Putnam, Department of Electrical Engineering; and Leonard E. Olsen and Earle C. Gregg, Department of Physics. Supplemental lectures and demonstrations will be given by the scientific staff of the General Electric Company.

Colleges and Universities

A Department of Welding Engineering is being established in the College of Engineering of Ohio State University. The Department, the first of its kind in the United States, will offer undergraduate work leading to the degree of Bachelor of Welding Engineering and advanced study for engineers. Curricula will be developed to meet industry's demands for welding engineers.

A new science building at Grinnell College in which all natural and biological sciences will be integrated has been made possible by gifts to the College. Construction, total cost of which has been estimated to be \$500,000, will begin this spring. According to President Stevens, the new laboratories will provide facilities through which Iowa industries may be served along chemical and physical lines.

The University of Cincinnati Observatory has loaned a 10-inch triple-lens Cooke camera to Indiana University, Bloomington, as part of a nation-wide program of research on minor planets in which 18 major astronomical observatories are cooperating. The program is being sponsored by the American section of the International Astronomical Union, under the chairmanship of Paul Herget, director of the Cincinnati Observatory, who now publishes the Union's *Minor Planet Circulars*. The loan of the Cooke camera will save much time

and expense for Indiana, according to Frank Edmondston, head of the Department of Astronomy, who explained that it would have required a year to obtain such a camera, which normally costs about \$6,000. The University of Minnesota Department of Astronomy has also loaned Indiana a "Blink" comparator, which aids in finding moving objects in the sky. In addition, Indiana has purchased a plate-measuring machine, which measures the movements of bodies in space, with a \$7,500 grant from the Research Corporation of New York. The three new pieces of equipment will open up new fields of planet study at Indiana; the larger photos can be examined on the "Blink" comparator and checked for movement by submitting a series of photos to the plate-measuring machine. Principal objective of the cooperative study is to locate objects which have strayed widely from their predicted positions.

Industrial Laboratories

The Wm. S. Merrell Company has recently made several additions to the staff of its Research Laboratories. Virgil W. Gash and Henry E. Fritz, who recently obtained the M.S. degree from the University of Illinois, have joined the Organic Department and the Organic Production Research Department, respectively; Paul A. Tuerek, a graduate of the Cincinnati College of Pharmacy, has joined the Analytical Department; and F. Joseph Murray, who a short time ago received his Ph.D. from Purdue University, is now working in the Bacteriology Department.

Ray Kupke, formerly associated with Ayerst, McKenna, and Harrison, has joined Endo Products, Inc., as head of production control.

Sharp & Dohme, Inc., Philadelphia, Pennsylvania, has appointed C. Paul Hegarty, research associate, Department of Bacteriology, as director of antibiotic research, and L. D. Wright, research associate, Department of Pharmacology, as director of nutritional research. The newly created Antibiotic Department represents an expansion in the Company's research program.

J. W. McCoy, vice-president and member of the Executive Committee, E. I. du Pont de Nemours and Company, retired January 1 but will continue to serve as a director. At the same time, William H. Ward, general manager of the company's Explosives Department, was made a director, vice-president, and member of the Executive Committee.

Meetings

A conference on "Current Trends in Social Psychology" will be held March 4-5 at the University of Pittsburgh. The speakers will include Ronald Lippitt, K. T. Behanan, Jerome S. Bruner, J. L. Moreno, Robert K. Merton, Paul F. Lazarsfeld, and James G. Miller. The conference is open to psychologists, graduate students of psychology, and members of related fields. Tickets of admission may be obtained without charge from the Department of Psychology, University of Pittsburgh, Pittsburgh, Pennsylvania.

The International Geological Congress announces that its 18th Session will be held August 25 through September 1, 1948, in Great Britain with principal meetings in the Royal Albert Hall and the lecture theatres of the Royal Geographical Society and the Imperial College of Science and Technology. The Rt. Honorable Sir John Anderson has accepted the office of honorary president of the General Organizing Committee. Prof. H. H. Read, president of the Geological Society of London, has succeeded the late Sir Thomas Holland as president of the General Organizing Committee and president-designate of the Congress.

Total attendance at the Congress is expected to reach 2,000, 28 governments and about 160 universities and scientific institutions already having accepted invitations to be represented by official delegates. Among the subjects to be discussed are: problems of geochemistry; metasomatic processes in metamorphism; rhythm in sedimentation; geological results of applied geophysics; geology of petroleum; geology, paragenesis, and reserves of the ores of lead and zinc; geology of sea and ocean floors; the Pliocene-

Pleistocene boundary; faunal and floral facies and zonal correlation; correlation of continental vertebrate-bearing rocks; earth movements and organic evolution; and other subjects. Problems of African geology will be considered at open meetings of the Association des Services Geologiques Africains, and selected paleontological topics will be discussed by the International Paleontological Union. A series of meetings on mineralogy and geology of clays will be organized in conjunction with the Clay Minerals Group of the Mineralogical Society. Sir Edward Bailey and Prof. O. T. Jones will deliver special addresses to the General Assembly of the Congress on the subject of the structural history of Britain.

A series of 37 long geological excursions are to be arranged between August 7 and September 18 as part of the Congress program, in addition to shorter excursions and visits to scientific institutions between August 22 and September 3.

All communications should be addressed to the General Secretaries, 18th Session International Geologic Congress, Geological Survey and Museum, Exhibition Road, London, S.W. 7, England.

The Cracow Cosmic Ray Conference

A conference on cosmic rays was held October 6 to 11, 1947, in Cracow, Poland. The Conference was the first called since the war by the Cosmic Ray Commission of the International Union of Physics, the president of which is Prof. Clay and the secretary, Prof. Pierre Auger. The Polish Government and the University of Cracow acted as hosts. A grant from UNESCO enabled a number of physicists from distant locations to participate.

The local committee of the University of Cracow, headed by Prof. Weyssenhoff, provided all facilities for the meetings and for visits to the laboratory and were most helpful in all connections.

More than 15 papers were read during the 9 sessions, one of which was held 100 meters underground, at the salt mines of Wieliczka. The discussions following each session were not

limited in time in order to permit full exchange of ideas and information.

Besides the general conference, two special sessions of the Cosmic Ray Commission of the International Union of Physics were held to discuss special problems of interest in the field of cosmic radiation.

Several resolutions were passed. One looked toward a conference of the Commission to be held in Europe in the period July 1 to September 1, 1949. A second, given in full below, dealt with names for the elementary particles. A third authorized the preparation and publication of a small pamphlet to list men and laboratories all over the world concerned with problems of cosmic ray physics. It was arranged that any suggestions made in this latter connection should be sent to Prof. Auger in Paris.

Among the subjects discussed during the Conference were the new discoveries of Dr. Powell, of Bristol, of two types of mesons; the theoretical interpretation of experiments on cosmic rays by Dr. Heitler and Dr. Wheeler; the extensive atmospheric showers (Auger showers), the penetrating showers, and the nature of cosmic ray particles.

Resolution on names for the elementary particles. The Cosmic Ray Commission of the International Union of Physics, in its meeting at Cracow (October 9, 1947):

(1) Recognizes the convenience of uniform names for the elementary particles.

(2) Recognizes that it may be undesirable to make an official recommendation on name in any particular case until widespread usage justifies such a recommendation.

(3) Notes that the term *nucleon* has found quite general recognition as a common term to denote both neutrons and protons.

(4) Recommends, therefore, that the term *nucleon* receive official recognition for this purpose.

(5) Reports that charged particles of mass intermediate between the mass of an electron and the mass of a proton (a) are generally called *mesons* in Argentina, Brazil, Denmark, Mexico, Eire, England, Holland, Italy, Norway, Sweden, Switzerland, and the USSR; (b) are called *mesotrons* and *mesons* by comparable numbers of investiga-

tors in the United States; and (c) are in France sometimes called mesotons, but more often mesons.

(6) Recommends no official action on name for the particle of intermediate mass until there is greater unanimity of usage, but

(7) Proposes in accordance with the unanimous desire of its members to employ the term meson in the report of the proceedings of the Cracow Conference.

(8) Recognizes the general use of the term *electron* to denote both positive and negative particles of electronic mass.

(9) Looks with favor upon the terms *positon* and *negaton* as means to distinguish between the two signs of charge.

(10) Asks the Secretary of this Conference to communicate this resolution to the editors of *Nature*, *The Physical Review*, *Le Journal de Physique*, and to the Secretary of the Academy of Sciences of the USSR.

John A. Wheeler, Department of Physics, Princeton University, who kindly prepared the above report, was the only American scientist to attend the Conference. In the event that our readers may wish to contact others in attendance, their names are listed below:

A. Arley, Copenhagen; P. Auger, Paris; J. Barnothy, Budapest; G. Bernardini, Rome; P. Blackett, Manchester; J. Clay, Amsterdam; A. Duperier, London; P. Cosyns, Brussels; P. Fleury, Paris; A. Freon, Paris; M. Forro, Budapest; B. Gross, Rio de Janeiro; W. Heitler, Dublin; L. Janko, Praha-Pankro; L. Janossy, Dublin; V. Kunzl, Bratislava; Prof. Leprince-Ringuet, Paris; R. Maze, Paris; J. A. Montgomery, Manchester; V. Petržilka, Praha II; C. F. Powell, Bristol; J. Slavik, Praha II; V. Trkal, Praha II; E. Zacek, Praha II; J. Adamozewski, Gdansk; J. Blaton and O. Blaton, Krakow; I. Bobr and B. Buras, Warszawa; Inz. Burzynski, Gdansk; E. Omochowski, Lodz; Inz. S. Fabiani, A. Garnysz, J. Gierula, and J. Gorski, Krakow; J. Gryeza, Poznan; Prof. Gunther, Warszawa; A. Hrynkiwica, Krakow; Prof. Ingarden, Wroclaw; A. Joblonski, Torun; A. Jagielski, J. Janik, and L. Jurkiewicz, Krakow; E. Juszkiwica, Gdansk; E. Kalinowska,

Swider; J. Kalisz and M. Kogut, Krakow; T. Kopcewicz, Warszawa; M. Kunisz, Krakow; S. Loria, Wroclaw; S. Majewski and Dr. Majewska, Warszawa; B. Makiej, Krakow; T. Malarski, Gliwice; M. Massalski, M. Massalska, and M. Miesowicz, Krakow; St. Morkowski and K. Morkowska, Dzierzoniew; T. Morstin, Krakow; M. Mucicki, Poznan; L. Natanson, Warszawa; H. Niewodniczanski, Krakow; W. Niklibore, Wroclaw; C. Pawlowski, Warszawa; T. Piech, Krakow; A. Piekara, Gdansk; J. Pniewski, Warszawa; M. Puchalik, Gliwice; J. Rayski, J. Rolinski, W. Rubinowica, Prof. Rzewuski, and T. Skalienski, Warszawa; E. Skorko and M. Skorko, Lodz; A. Soltan and L. Sosnowski, Warszawa; D. Stachurska, Lublin; Prof. Szpilecki, Gliwice; W. Scislowski, Warszawa; B. Sredniawa, Krakow; B. Twarowska, Warszawa; W. Turczynski, Toru; W. Urbanski, Lublin; M. Wertenstein, Warszawa; J. Wesolowski, C. Wesolowska, J. Weyssenhoff, and K. Zakrzewski, Krakow.

Elections

The Mathematical Association of America, at its annual meeting on January 1 at the University of Georgia, Athens, Georgia, elected Saunders MacLane, University of Chicago, first vice-president. W. L. Ayres, Purdue University, and C. R. Adams, Brown University, were elected to the Board of Governors for three-year terms. L. R. Ford, Illinois Institute of Technology, continues as president for another year. H. M. Gehman, University of Buffalo, began his five-year term as secretary-treasurer at this meeting.

The Chauvenet Prize of the Association has been awarded to Paul R. Halmos, of the Institute for Advanced Study, for his paper on "The Foundations of Probability," published in the *American Mathematical Monthly* for November 1944. The Chauvenet Prize of \$50 is awarded every three years for a "noteworthy, expository paper published in English by a member of the Association."

The American Physical Society's Division of High-Polymer Physics announces the election of Hubert M. James as chairman for 1948, with Richard B. Stambaugh, Goodyear Tire

and Rubber Company, serving as vice-chairman and a member of the Executive Committee. W. James Lyons, Firestone Tire and Rubber Company, was re-elected to the Executive Committee, in addition to serving as division secretary. R. S. Spencer was elected treasurer.

The Northwest Scientific Association has elected Otis W. Freeman, head of the Division of Physical Sciences, Eastern Washington State College of Education, as president for 1948. Robert F. E. Stier, of Spokane, will serve as vice-president, and L. C. Cady, executive secretary of the University of Idaho Research Council, as secretary-treasurer. H. Walter Steffens, head of the Division of Biological Sciences, University of Idaho, was added to the Council and made program chairman. Three-year trustees are H. T. Gisborne, head of the Forest Service Protective Division; E. E. Hubert, chief pathologist for I. F. Laucks Inc., Spokane; and H. B. Hansen, Department of Botany, Oregon State College. W. R. Hatch will continue as editor of *Northwest Science*, and henceforth the journal will be published by the Washington State College press.

The next annual meeting of the Association will be held the week following Christmas 1948.

Linus C. Pauling, chairman, Division of Chemistry and Chemical Engineering, California Institute of Technology, has been elected president of the American Chemical Society for 1949. Dr. Pauling will succeed Charles A. Thomas, executive vice-president and technical director, Monsanto Chemical Company, St. Louis, president of the Society for 1948.

NRC News

The Committee on Research in Endocrinology has announced that requests for grants-in-aid during the fiscal period July 1, 1948-June 30, 1949, will be received until February 29. Application blanks may be obtained by addressing the Secretary, Division of Medical Sciences, National Research Council, 2101 Constitution Avenue, Washington 25, D. C. In addition to a statement of the prob-

lem and research plan, the Committee would like information regarding the proposed method of attack, the institutional support of the investigation, and the uses to be made of the sum requested. No part of any grant may be used by the recipient institution for administrative expenses. Although the Committee makes grants in aid of research in the general field of experimental and clinical endocrinology, applications for support of research in the problems of sex in the narrower sense cannot be given favorable consideration, and investigators seeking support in this field should direct their proposals to the Committee for Research in Problems of Sex of the National Research Council. The Committee on Research in Endocrinology will, however, continue to give consideration to the support of studies of the effect of sex hormones on nonsexual functions, such as on general metabolism and on the metabolism of steroid hormones.

Deaths

Leonard C. Miller, 33, senior physicist, Clinton National Laboratory, died December 22 as a result of injuries received in an automobile accident on December 19 in Washington, D. C., where he had attended a meeting of the Subcommittee on Beta and Gamma Ray Measurements of the Committee on Nuclear Science, National Research Council.

Stroud Jordan, 62, industrial chemist in charge of the Manufacturers' Service Division, American Sugar Refining Company, died December 28 at his home in Miami.

Alfred North Whitehead, 86, professor of philosophy emeritus, Harvard University, died December 30 of a cerebral hemorrhage at his home in Cambridge, Massachusetts.

James W. Goldthwait, 67, Hall professor of geology, Dartmouth College, and a member of its faculty for 39 years, died of a heart attack January 2, at his home in Hanover, New Hampshire.

Frank Burnett Dains, 78, professor emeritus of chemistry, University of Kansas, died January 5. Dr. Dains

had been a member of the Kansas faculty since 1911.

Harry B. Riffenburgh, 56, associate professor of chemistry, Virginia Polytechnic Institute, died January 5, after 19 years of service on that faculty.

F. Petrak, librarian of the Botanische Abteilung of the Naturhistorisches Museum in Vienna, reports in a recent letter to Lawrence S. Thompson, Western Michigan College, that all the Museum's books and specimens had been returned from evacuation points by early in the fall of 1946 and that the work of the Museum has been going forward, even though under great difficulties, since that date. The greatest loss was suffered when a part of the herbarium was burned at an evacuation point toward the end of May 1945. Some 2,000 fascicles of the collection were lost, and it now lacks all families in the system up to the Lauraceae, with the exception of grasses and orchids.

Dr. Petrak reports that the greatest hindrance to effective work at present is the absence of scientific journals published outside the Nazi-dominated countries during the war. The museum building suffered 20 direct hits during the bombardment of Vienna, but relatively little damage was sustained, and that has been repaired. The severest physical hindrance to work is the absence of fuel with which to heat the building.

During the war, 5 volumes of the *Annales Mycologici* appeared. Since the editor, H. Sydow, died on June 6, 1946, the *Annales* will be continued by a new periodical, *Sydowia*, named in his honor, which will be under the editorship of Dr. Petrak.

The Marine Biological Laboratory, Woods Hole, Massachusetts, has successfully completed a drive to obtain \$10,000 for a new collecting boat. The drive started last spring, and a large proportion of the total amount received was given by workers at the Laboratory and by members of the Corporation of the Laboratory. In all, there were 220 contributors.

The new boat, capable of making 15 knots, is already under construc-

tion and will be completed before the summer season begins. In the meantime, one old collecting boat has been retired after many years of hard service. The fleet is therefore no larger than before. But the needs of the Laboratory for living material continues to grow. For that reason still another boat must presently be secured.

The California State Department of Agriculture, Bureau of Plant Pathology, has several permanent positions open for assistant plant pathologists in the Los Angeles area, with an entrance salary of \$281 per month. Applicants must be college graduates whose major study was plant pathology, with two years of plant inspection and plant disease control work. Additional qualifying experience may be substituted for education on a year-for-year basis. Duties to be performed include surveys and inspections of agricultural crops, nursery plants, natural vegetation, and forest trees for plant diseases; the planning and organization of plant disease surveys; the diagnosis of plant diseases in the field; direction of crews of men in survey and eradication work; and the compilation of records and direction of compilation of records. Those interested should contact Charles P. Cusick, Personnel Officer, Department of Agriculture, Room 501, State Office Building #1, Sacramento, California.

Make Plans for—

American Institute of Electrical Engineers, Winter General Meeting, January 26-30, Pittsburgh, Pennsylvania.

American Society for Horticultural Science, January 26-31, Palmer House, Chicago, Illinois.

American Council of Learned Societies, January 29-30, Westchester Country Club, Rye, New York.

American Society of Heating and Ventilating Engineers, February 2-5, New York City.

American Philosophical Society, February 13-14, 104 South 5th Street, Philadelphia, Pennsylvania.

TECHNICAL PAPERS

Effect of Crude Polyporin on Seed Germination and Root Growth: A Preliminary Study

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Germination experiments with gram (*Cicer arietinum* L.) seeds soaked for 24 hrs in water containing 3 cc of crude filtrate ('Polyporin,' 1) showed distinct retardation of germination when compared with the control soaked in water; even the seedlings which ultimately developed were fewer in number and shorter in length than those of the control.

Rings were cut from the outer cortex of branches of guava (*Psidium guyava* L.) trees in the College Garden, and the exposed surfaces were kept smeared with (1) crude Polyporin for 24 and 48 hrs, respectively, being



FIG. 1

finally wrapped over with moist cotton wool. Neighboring branches similarly treated were covered with cotton wool soaked in (2) distilled water and in (3) 4% glucose, pea-decoction, and salts (the blank medium commonly used in our 'Polyporin' experiments). In the case of (1), Polyporin was washed out with distilled water after 24 and 48 hrs, respectively, and the regions were covered with moist cotton wool. All the treated parts of the branches were watered daily with distilled water. In the course of 26 days, 2 young roots protruded from the branch treated with Polyporin for 24 hrs, and 6 roots from the region treated with Polyporin for 48 hrs. The roots were quite strong, healthy, and fresh (Fig. 1). Not a single root-formation was observed in the cases of (2) and (3). The experiments are being repeated with *Mangifera indica* L., *Eugenia Jambos* L. trees, and *Areca oleracea* in our College Garden.

According to Ribeiro (3), penicillin was found to inhibit germination of seeds after a 24-hr treatment with

the antibiotic. With crude penicillin Smith (5) has obtained similar results. None of the crystalline penicillins tested by Smith retarded germination appreciably. From plant tissue-culture experiments Ropp (4) held that commercial penicillin causes proliferation of cambial tissue, followed by an abundant production of roots. Highly purified penicillin failed to damage the growing sarcomatous cells in mice experiments carried out by Lewis (2), while the yellow penicillin used in proper dosage damaged the growing sarcomatous cells without injuring the normal cells.

These results show that crude Polyporin contains substances which cause partial inhibition of seed germination and, like indole-3-acetic acid and indole-butyric acid, promote root growth.

Addendum: Since writing the above, we have succeeded in obtaining root development from *Eugenia Jambos* stems treated with Polyporin for 48 hrs.

References

1. BOSE, S. R. *Nature, Lond.*, 1946, 158, 292.
2. LEWIS, M. R. *Science*, 1944, 100, 314.
3. RIBEIRO, D. F. *Science*, 1946, 104, 18.
4. ROPP, R. S. DE. *Nature, Lond.*, 1946, 158, 555.
5. SMITH, W. J. *Science*, 1946, 104, 411.

Preflooding Treatments With DDT for Mosquito Control¹

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The residual toxicity of DDT has made possible the use of preflooding treatments for the control of mosquito larvae. This method was first used with favorable results by Wisecup and Deonier in 1944 (3) on small breeding places of species of *Psorophora* in Florida. Shortly afterward, Wisecup, *et al.* (2) found that preflooding treatments with DDT sprays applied by airplane effectively controlled mosquitoes in Arkansas rice fields. In 1946 Horsfall (1) employed an adaptation of this method by adding DDT to fertilizer to control *Psorophora confinnis* (L.-Arr.) in rice fields. Wisecup, *et al.* (4), however, reported poor control of salt-marsh mosquitoes, *Aedes taeniorhynchus* (Wied.) and *A. sollicitans* (Walk.), with relatively low dosages of DDT sprays (emulsions and solutions) applied by airplane. Recently Yates and Gjullin

¹ This work was conducted under a transfer of funds from the Office of the Surgeon General, U. S. Army, to the Bureau of Entomology and Plant Quarantine.

(5) reported successful results with preflooding treatments applied to breeding areas of *Aedes* mosquitoes along the Columbia River in Oregon. The present paper contains a brief report of tests made with DDT applied as preflooding treatments in 1946. Laboratory tests compared different formulations, and a field test was made in which a dust was applied with hand dusters against salt-marsh mosquito larvae.

In the laboratory tests, four series of two dishes each, one containing a layer of sand and the other a layer of muck, were treated with DDT at a rate equivalent to 0.2 lb/acre. One series of dishes was treated with a solution of DDT in deodorized kerosene, one with a xylene-Triton X-100² emulsion containing 25% of DDT, one with

of each species) were introduced. The results of these tests are shown in Table 1.

The mortality decreased with successive floodings in nearly all the dishes, and, except in those treated with the emulsion, the decrease was usually greater on muck soil than on sand. At the end of 12 weeks the highest mortality of *A. quadrimaculatus* (more than 90%) followed treatment with the suspension, whereas the highest kill of *Ae. aegypti* was obtained with the dust. The mortality of *C. quinquefasciatus* was low in all the dishes. The emulsion showed the poorest lasting qualities.

A field test was made with a 10% DDT dust, at 1 lb of DDT/acre, on 20 acres of a salt-marsh island off the east coast of Florida. The remainder of the island was untreated and served as a check area. The application was made on May 13, and the island became flooded by rainfall or high tides on May 21, June 4, July 11, and August 1. The treatment gave complete control of the larvae that hatched after the first three floodings. After the fourth flooding a few larvae were found, but the number was less than 1/dip in the treated area as compared with 500 or more/dip in the untreated area. The larvae that did develop in the treated area were retarded in growth and either died in the pupal stage or became weak adults.

These results indicate that preflooding treatments with DDT dust may be very effective for use against salt-marsh mosquitoes.

References

1. HORSFALL, W. R. *J. econ. Ent.*, 1946, **39**, 723-725.
2. WISECUP, C. B., BROTHERS, W. C., and EIDE, P. M. *J. econ. Ent.*, 1945, **38**, 686-688.
3. WISECUP, C. B., and DEONIER, C. C. *J. econ. Ent.*, 1945, **38**, 250-252.
4. WISECUP, C. B., WHITE, W. C., and MINNICH, V. S. *Mosquito News*, 1947.
5. YATES, W. W., and GJULLIN, C. M. *Mosquito News*, 1947, **7**, 4-6.

The Presence of an Alcoholic, Ketonic Derivative of Estrone in Human and Rabbit Blood¹

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The existence of intermediates in the metabolism of the estrogenic steroid hormones other than the three so-called natural estrogens (estradiol, estrone, and estriol) has long been suspected. The poor recoveries of injected material (averaging 20% of the administered dose) in the urine of both human and animal subjects has given this hypothesis much weight. The course of estrogen metabolism has been studied intensively by many methods. Doisy, Thayer, and Van Bruggen (1), Pineus and Pearlman (5), and Heard (2) have reviewed the field thoroughly.

¹ Supported in part by grants from the American Cancer Society (Massachusetts Division, Inc.), the Foundation of Applied Research, and the Donner Foundation.

TABLE 1

RESIDUAL TOXICITY OF DIFFERENT DDT FORMULATIONS APPLIED AS PREFLOODING TREATMENTS FOR THE CONTROL OF MOSQUITOES AT A RATE EQUIVALENT TO 0.2 LB OF DDT/ACRE (3 REPLICATIONS)

Species	Kind of soil	% mortality 48 hrs after application of :			
		Oil solution	Emulsion	Suspension	Dust
<i>First flooding, 3rd week after treatment</i>					
<i>A. quadrimaculatus</i>	Muck	100	73	100	100
	Sand	93	47	100	90
<i>Ae. aegypti</i>	Muck	90	60	88	98
	Sand	87	97	100	100
<i>C. quinquefasciatus</i>	Muck	80	35	15	36
	Sand	32	40	97	68
<i>Second flooding, 8th week after treatment</i>					
<i>A. quadrimaculatus</i>	Muck	72	98	100	100
	Sand	100	38	100	100
<i>Ae. aegypti</i>	Muck	87	38	95	88
	Sand	72	10	100	100
<i>C. quinquefasciatus</i>	Muck	17	7	20	32
	Sand	58	0	92	53
<i>Third flooding, 12th week after treatment</i>					
<i>A. quadrimaculatus</i>	Muck	58	32	93	50
	Sand	93	3	95	85
<i>Ae. aegypti</i>	Muck	52	5	22	90
	Sand	72	7	92	100
<i>C. quinquefasciatus</i>	Muck	10	2	8	17
	Sand	50	5	52	53

a suspension made with 50% water-dispersible DDT powder, and the fourth with a dust containing 5% of DDT in talc. To obtain uniform distribution of the insecticide, $\frac{1}{4}$ " of water was placed in the dishes and allowed to evaporate. The dishes were reflooded at the end of the 3rd, 8th, and 12th weeks, in each case after complete evaporation of the water. The water was added carefully to avoid disturbing the soil. Immediately afterward, late third-instar larvae of *Anopheles quadrimaculatus* Say, *Aedes aegypti* (L.), and *Culex quinquefasciatus* Say (20

² An aralkyl polyether alcohol.

The work to be presented here indicates the presence of an intermediate which has not been noticed in the past. The studies were made in part on human blood, and on human and rabbit blood diluted by White's solution (7). The diluted bloods were used as the perfusing media for human and rabbit organs maintained on a perfusion pump for varying lengths of time. Each perfusion study lasted 24 hrs.

The fluids were extracted by a technique originally

(2) Estrone should appear only in the nonalcoholic fraction.

Errors in manipulation in these techniques would permit ketonic material to enter the nonketonic fraction and alcoholic substances to enter the nonalcoholic fraction. Thus, the appearance of activity in the ketonic alcoholic fraction can hardly be ascribed to improper separation.

The method of bioassay employed was a modification of the Allen-Doisy technique as previously described (4).

TABLE 1*

Fluid	Exp. No.	Volume in cc combined fluids	Perfused through	Estrone added (mg)	Day of organ perfusion	Estrone equivalents (as μ g) in		
						non-ketonic fraction	ketonic alcoholic	ketonic non-alcoholic
Rabbit† blood and 50% White's solution	1 1a	250 250	Rabbit thigh muscle	0 2.3	1 2	40 750	110 710	10 560
Rabbit blood and 50% White's solution	2 2a	100 275	Rabbit thigh muscle	0 2.3	1 2	0 175	0 23	0 30
Human blood (male)	3	200		Not perfused		25	700	0
Human blood (male) and 50% White's solution	4	420	Human skin rope graft	2.3	1	240	300	40
Human blood (male) and 50% White's solution	5 6 7 8 9	282 232 210 146 325	Human testicle " " "	2.6 2.3 0 0 2.6	1 2 3 5 7	25 0 0 40 72	400 200 Trace 20 400	20 0 0 70 0
Human blood and 50% White's solution	10	150	Blank run using fine cannula instead of organ	2.6	1	10	42	426
Human blood and 50% White's solution	11	250	"	2.6	1	26	40	106

* Values given in the table are in estrone equivalents as determined by Allen-Doisy assay. Error of assay was $\pm 25\%$. Listed also are the fluids from which extractions were made, the day of the perfusion run on which the experiment was made, and the organ perfused. Only one specimen, human blood, was not perfused but extracted as received from the blood bank. Total volume extracted in each instance.

† Blood taken from follicle stimulating hormone-treated female rabbits.

described by Schiller and Pincus (6) and Pincus and Pearlman (3). The separations of the component estrogens involved the use of the Girard and succinic anhydride reactions in the order listed. We have added to the technique only the following:

(1) All ether employed in the extractions was decanted from a saturated ferrous sulfate solution not more than 1 hr before use.

(2) All evaporations and distillations were conducted in an atmosphere of nitrogen.

According to previous experience with this technique, the following partitions should occur:

(1) Estradiol and estriol should appear only in the non-ketonic fraction.

As seen in Table 1, biological activity was found in the alcoholic fraction whether or not estrone had been added to the fluids. Several extractions not listed in the table, which were run on untreated blood, demonstrated estrogen titers comparable to Experiment 7.

The addition of estrone to the medium during a perfusion appeared to increase the amount of material found in the alcoholic fraction (see Experiments 1, 1a, 2, 2a, 5, 6, 7, 8, 9).

The cause of the decrement in estrone concentration in the experiment where a blank run on added estrone was made (Experiments 10 and 11) is not understood at present. Each perfusion including the blank was free of fungi or bacteria throughout the run. This raises the

possibility that simple incubation of estrone in blood will lead to degradation to inactive compounds as well as conversion to the new compound suggested. Previous determinations on short-time incubation of estrone in blood have led to recoveries approaching 100% of the activity added. Such tests were made both by us and by Pincus and Schiller (6).

It therefore appears reasonable to assume from these data that an alcoholic ketone derivative of estrone is normally present in human and rabbit blood.

It may be added that our experience with the compound indicates an extreme degree of lability. To this, more than to differences in metabolic activity, we ascribe the deviations in results such as those seen between the two experiments using rabbit muscle (Experiments 1 and 2).

References

1. DOISY, E. A., and THAYER, S. A. *Fed. Proc.*, 1942, **1**, 202.
2. HEARD, R. D. H. Laurentian Hormone Conference, 1945. (Unpublished.)
3. PINCUS, G., and PEARLMAN, W. H. *Endocrinology*, 1941, **29**, 413.
4. PINCUS, G., and PEARLMAN, W. H. *Cancer Res.*, 1941, **1**, 907.
5. PINCUS, G., and PEARLMAN, W. H. *Vitamins and Hormones*, 1943, **1**, 293.
6. SCHILLER, J., and PINCUS, G. *Science*, 1943, **98**, 410.
7. WHITE, P. R. *Growth*, 1946, **X**, 231.

Increase of Herbicidal Action of Concentrate 40 and Oil Emulsion by 2,4-D

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It is well known that 2,4-D is ineffective as a herbicide in the control of grasses. Nonselective herbicides such as Concentrate 40 and oil emulsions are often used to control grass weeds. Preliminary experiments conducted at the Federal Experiment Station in Puerto Rico have shown that Concentrate 40 + 2,4-D¹ and oil emulsion fortified with Santophen 20 + 2,4-D² both suppressed the population of "cohitre," or day flower (*Commelina longicaulis* Jacq.), and "bejuco de puerco" (*Ipomoea* spp.) (broad-leaf plants easily eradicated with 2,4-D sprays) more than the same nonselective sprays without 2,4-D. The combination sprays also suppressed more weeds than 2,4-D alone. The results indicated that Concentrate 40 and oil emulsion fortified with Santophen 20, when used as a combination spray with 2,4-D, did not inhibit the lethal effects of 2,4-D and that it may be more effective than either nonselective herbicides when used alone on grass control.

In another experiment, an area completely covered with Bermuda grass (*Cynodon dactylon* (L.) Pers.), which is unaffected by 2,4-D and very resistant to arsenical, was

¹ Consisting of 0.42% arsenic trioxide, 0.25% Santobrite (sodium pentachlorophenate), and 0.25% sodium chlorate plus 0.10% 2,4-D.

² Consisting of 10% diesel oil emulsion fortified with 0.7% Santophen 20 (pentachlorophenol).

divided into 10 equal plots. Five plots were treated with Concentrate 40 and 5 with 0.1% sodium salt of 2,4-D in Concentrate 40 at the rate of 175 gal/acre. Two uniform applications of both spray treatments were made at 4-week intervals, and the results recorded 20 days after the last application. The addition of 2,4-D to Concentrate 40 increased its herbicidal action against Bermuda grass by 50%. Plots sprayed with Concentrate 40 alone were completely covered with weeds, 60% Bermuda grass and 40% nutgrass (*Cyperus rotundus* (L.)). In plots sprayed with 0.10% 2,4-D in Concentrate 40 the area was covered with only 40% Bermuda grass and 5% nutgrass.

The results indicate that 2,4-D possibly activated the constituents in Concentrate 40, or vice versa, with a resulting synergistic reaction. The increased herbicidal effectiveness of the combination sprays may also be due to the injury caused by the constituents of Concentrate 40 (arsenic trioxide, Santobrite, and sodium chlorate), which enables the 2,4-D to enter the plant and exert its physiological effect.

Importance of the Methoxy Group in Antifibrillatory Compounds¹

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It is of singular interest that all the potent compounds now in clinical use for their antifibrillatory activity possess a methoxy group. These include quinine (7), quinidine (4), α -fagarine (3), and recently atabrine (5). The methoxy group is present in a number of other drugs—notably, the antimalarial drugs, certain of the opiates, and colchicine. Of these later drugs, only to papaverine has antifibrillatory activity been attributed (6). In a preliminary study to clarify this point, measurements were made of the antifibrillatory activity of cinchonine and N-methyl-dibenzyl-amine with quinidine and α -fagarine as controls. Cinchonine was selected because it has the exact structure of quinidine minus the methoxy group. Similarly, N-methyl-dibenzyl-amine is closely related in structure (one less carbon in the amine chain) to α -fagarine, but lacks two methoxy groups and one dioxymethylene group.³ To aid in the comparison of these drugs the changes induced on blood pressure, pulse, electrocardiogram, and the acute fatal toxicity were also studied.

Cats anesthetized with Dial-urethane given intraperitoneally were used. The chest was opened and a pericardial cradle made. Electrodes were attached to the right auricle about 8 mm apart, always in the same location. The stimulating current was generated by a thyratron.

¹ Work done under a grant from the Sterling-Winthrop Research Institute.

² Research Fellow in Physiology and Pharmacology, Long Island College of Medicine.

³ N-methyl-dibenzyl-amine and α -fagarine were obtained from the Sterling-Winthrop Research Institute; quinidine and cinchonine, from the Fisher Scientific Company.

tron stimulator at a frequency of 600 impulses/min. The current necessary to just induce fibrillation was reduced to the minimum by connecting in series a suitable variable resistor in the external circuit. The resistance of the preparation was also measured. The maximum output of the stimulator was 250 v. Thus, by measuring the maximal resistance at which one could induce fibrillation, the threshold could be calculated in milliamperes. Most often this varied from 2 to 8 Ma, a value agreeing closely with that of Wegria and Nickerson, who used a somewhat similar method (6).

Blood pressure and pulse were recorded from the carotid artery. The EKGs were taken with a string galvanometer by use of needle electrodes inserted subcutaneously in the standard limb lead positions. Single doses of a particular drug were always given intravenously in 5 mg/kilo amounts. The typical experiment was run as follows: First, a series of at least three control thresholds were

had been given. Cinchonine was much less toxic than quinidine, the acute fatal dose averaging 80 mg/kilo. Moreover, the EKG changes observed in the case of quinidine were minimal in the case of cinchonine up to doses of 50 mg/kilo. A-fagarine was nearly 5 times more active than quinidine (308%). In every other respect it resembled the effects of quinidine on blood pressure, pulse, and EKG. Its acute fatal dose was greater (32.5 mg/kilo). N-methyl-dibenzyl-amine was not active in raising the fibrillation threshold. This is contrary to the results of De Espanes, *et al.* (3), who assigned considerable antifibrillatory activity to this drug. We believe our results to be correct, because this drug raised the blood pressure and increased the pulse rate. Moreover, no EKG changes were observed with any dose. Unfortunately, due to a shortage of the supply of the drug the acute fatal dose could not be obtained, but it was obviously much greater than 50 mg/kilo.

TABLE 1

Drug	No. of cats	Maximum avg. % inc. in threshold (Dose in par.)	Avg. % inc. in threshold over 1-hr period	Blood pressure	Pulse	EKG changes	Avg. acute intravenous toxicity (mg/kilo)
Quinidine	7	250 (10 mg)	69	Fall	Slowed	Marked	47
Cinchonine	7	101 (15 ")	67	Fall	Slowed	Slight	80
α -Fagarine	4	660 (5 ")	308	Fall	Slowed	Marked	32.5
N-Methyl-dibenzyl-amine .	4	36 (10 ")	12	Rise	Quickened	None	None with doses over 50 mg/kilo

run, after which a 5-mg dose of the particular drug was given. Thresholds of fibrillation were taken immediately after (10 and 20 min). This procedure was repeated twice more. The changes in threshold reported in Table 1 are therefore the average result of 15 mg/kilo of drug in three divided doses at 20-min intervals. By giving 5-mg/kilo doses intravenously every minute and watching for cardiac arrest, the acute fatal toxicity was then obtained.

The results are summarized in Table 1. As was to be expected, quinidine proved to be an active antifibrillatory drug. By this method the average increase in fibrillation threshold was 69%. This was the figure obtained by averaging the results on 7 cats (9 separate thresholds on each cat over an hour period with a total dose of 15 mg/kilo). The maximum average effect of a 250% increase in threshold was observed after 10 mg/kilo had been given. There was a typical fall in blood pressure and a slowing of the pulse characteristic for this drug. The EKG changes consisted of widening the QRS complex and abnormalities of the S-T segment and T waves. There was frequently inversion of the QRS complex. The average acute fatal dose intravenously was 47 mg/kilo.

Surprisingly, cinchonine proved to be almost as active as quinidine. However, the maximum rise in threshold was only 101% and was obtained only after 15 mg/kilo

Clearly indicated is the fact that omission of the methoxy and the dioxymethylenic groups from the structure of α -fagarine renders it impotent as an antifibrillatory drug and also removes its toxicity. Moreover, the compound that remains, N-methyl-dibenzyl-amine, is a pressor drug. This is not unexpected in view of its relationship to the sympathomimetic amines (1). On the other hand, cinchonine, which lacks the methoxy group, still retains considerable antifibrillatory activity, but its toxicity is much less and the typical EKG changes of quinidine are only slightly evident. Therefore, this observation indicates that the methoxy group is not necessary in the structure of an antifibrillatory compound. This is in accord with the observations of Dawes (2). However, our results permit the conclusion that the methoxy group and its related dioxymethylenic group are extremely important in the structure of the antifibrillatory drugs. If this observation is confirmed, it provides important leads not only in the search for the ideal antifibrillatory drug but in the study of the metabolism of muscle contraction.

References

1. BEYER, K. H. *Physiol. Rev.*, 1946, **26**, 169.
2. DAWES, G. S. *Brit. J. Pharm. Chemotherapy*, 1946, **1**, 113.
3. DE ESPANES, E. MOISSET, and WEKSLER, B. *Proc. Soc. exp. Biol. Méd.*, 1946, **63**, 195.
4. FREY, W. *Klin. Wschr.*, 1918, **55**, 849.

5. GERTLER, M. M., and KARP, D. *Proc. Soc. exp. Biol. Med.*, 1947, **64**, 213.
6. WEGRIA, R., and NICKERSON, D. M. *J. pharm. exp. Therap.*, 1942, **75**, 50.
7. WENKEBACH, K. E. *Die unregelmässige Herzrhythmickeit und ihre klinische Bedeutung*. Leipzig: W. Engelmann, 1914.

Inactivation of Nutrients by Heating With Glucose¹

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Hill and Patton (1) found that the slight discoloration occurring during the autoclaving of media for the microbiological assay for L-tryptophan was caused by interaction with glucose, resulting in decreased growth of *Streptococcus faecalis* R. It was not known at that time whether the poorer growth resulted from destruction of nutrients or formation of growth inhibitors as products of the browning reaction. The work reported here indicates that the decreased growth is due to destruction of nutrients.

TABLE 1
LOSS OF L-TRYPTOPHAN DUE TO INTERACTION
WITH GLUCOSE

Treatment	Browning (% T/610)	Hydroxymethyl- furfural (%)	Tryptophan loss (%)
Unheated	100	0	0
Heated	81.5	0.52	60
Heated at pH 10 ..	41.5	2.25	26

It is known that the browning reaction is promoted by alkalinity, and that hydroxymethylfurfural is one of the chief reaction products. Advantage was taken of these facts in the following tests: Aliquots of a solution containing known amounts of L-tryptophan and D-glucose were heated under suitable conditions to cause browning similar in appearance to that which occurred during autoclaving of media. The extent of browning was measured by determining the decrease in transmission at 610 mμ in a Coleman spectrophotometer. Hydroxymethylfurfural content, used as an indicator of the concentration of browning reaction products, was estimated from the absorption increase at 284 mμ in a Beckman DU spectrophotometer. The loss of L-tryptophan resulting from the browning reaction was determined by microbiological assay using the sucrose medium to prevent further browning loss. Aliquots buffered at pH 10 were prepared to obtain samples in which browning was only partially due to interaction with tryptophan. These mixtures produced more browning in less time. Growth of *Str. faecalis* R

¹ Scientific Series No. 253, Colorado A & M College Experiment Station.

was measured turbidimetrically after 16 hrs by decrease in transmission at 610 mμ. At the dilutions used for assay, the browned samples were colorless at this wave length.

As shown in Table 1, better growth was obtained from the tryptophan-glucose sample heated at pH 10, in spite of the fact that more browning occurred and more hydroxymethylfurfural was formed. On the other hand, the solution containing only glucose and tryptophan, showing less browning and much less hydroxymethylfurfural formation although heated for a longer time, permitted poorer growth. These data indicate that decrease in growth was due not to formation of growth inhibitors as products of the browning reaction but to actual destruction of part of the tryptophan.

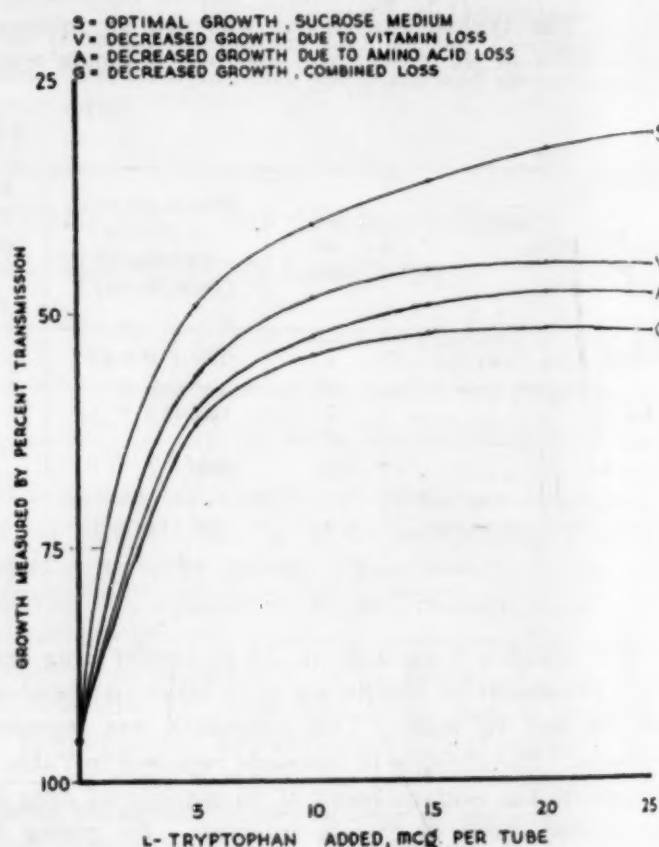


FIG. 1. Growth of *Str. faecalis* R in standard series for L-tryptophan assay, showing decreased growth due to autoclaving in presence of glucose.

It also appears that such destruction is not limited to tryptophan. Both L-lysine and DL-methionine, upon heating in the presence of glucose, underwent similar destruction, as determined by subsequent microbiological assay using synthetic amino acid media. Curve G (Fig. 1), which is a standard growth curve for L-tryptophan as obtained by the customary assay method using glucose in the medium, shows the total growth-decreasing effect of the browning reaction. Curve V resulted from the addition of a pure sterile solution of the amino acids to the autoclaved medium before inoculating, in an attempt to reveal the extent of vitamin destruction during autoclaving. Similarly, to produce curve A the vitamins were replaced after autoclaving, to show the extent of amino acid destruction. These curves indicate that nutrients in both the vitamin class and the amino acid class suffered

damage during autoclaving with glucose. The vitamins required in the medium (B complex) contain nitrogenous moieties which might conceivably react with glucose similarly to amino acids. Inactivation of nutrients was minimized by using sucrose instead of glucose in the medium (Curve S), as previously described by the authors (1).

Reference

1. HILL, E. G., and PATTON, A. R. *Science*, 1947, 105, 481.

Effect of Suspended Silt and Other Substances on Rate of Feeding of Oysters

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Our recent studies on the feeding of oysters (*Ostrea virginica*) with cultures of *Chlorella* sp., *Nitzschia closterium*, *Euglena viridis*, and other forms have shown that they feed most efficiently when the numbers of food microorganisms in the water are relatively small (2, 3). These conclusions are in agreement with the theoretical discussions of Kellogg (1) and Yonge (5). We found that both the filtrate of the cultures containing metabolic products of the cells and the cells themselves affected the rate of oyster feeding.

In continuing our studies on the feeding of oysters we substituted for living cells various turbidity-creating substances, such as fine silt collected from the tidal flats of Milford Harbor, a clay-like substance—kaolin (aluminum silicate), powdered chalk, and Fuller's earth. All these substances may sometimes be found under natural conditions in suspension in inshore waters. Silt, which is a mixture of organic and inorganic substances, is, of course, very common and always present in varying quantities in inshore waters inhabited by oysters.

The methods employed were virtually the same as those used in our earlier studies on the effect of different concentrations of microorganisms upon oysters (3). They consisted chiefly in recording, on the kymograph under normal conditions and when water was rendered turbid in various degrees, the rate at which the oysters pumped water through the gills and the changes in their shell movements. The concentrations ranged from 0.1 to 4.0 gm of turbidity-creating substances/l of water, except in the case of Fuller's earth, where only one concentration of 0.5 gm/l was used.

In the first series of experiments the water was made turbid by the addition of silt. Even when small quantities, such as 0.1 gm/l, were added, the type of oyster shell movement changed and the rate of pumping considerably decreased. The reduction averaged 57% (Fig. 1), but in some individuals the rate of pumping was decreased 87%.

A sharp decrease in the rate of pumping was always noticed when concentrations of 0.25, 0.5, 1.0, 2.0, and 4.0 gm/l of sea water were made. In concentrations of 1.0 gm of silt/l, the average rate of pumping decreased more

than 80%, reaching a decrease of about 94% in concentrations of 3 and 4 gm/l. Although such heavy concentrations seldom occur in nature, they may, nevertheless, arise during heavy floods or be created in areas where the bottom deposits are artificially disturbed, as happens in the case of channel dredging.

The results of the experiments with kaolin and chalk were similar to those obtained with silt (Fig. 1). The addition of even such small quantities of these substances as 0.1 gm/l noticeably decreased the rate of pumping. This became more evident as the concentrations were increased. Nevertheless, even in high concentrations, the

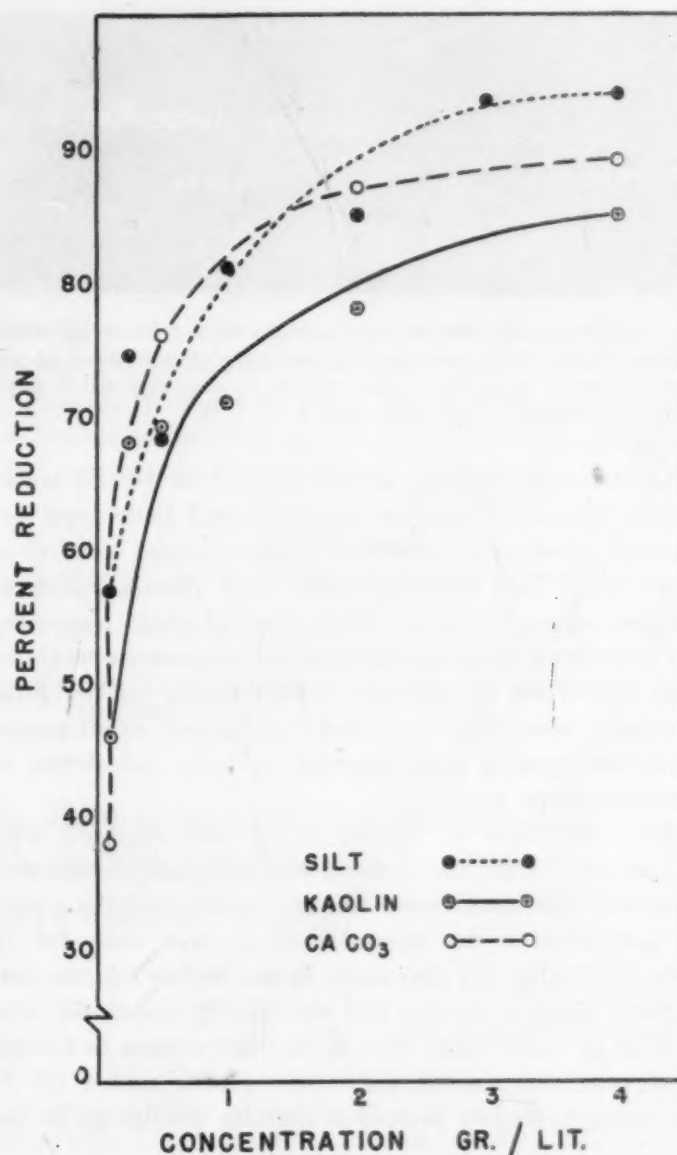


FIG. 1. Per cent reduction in pumping rate of oysters subjected to different concentrations of turbidity-creating substances.

majority of the oysters kept their shells open most of the time and pumped some water. Fuller's earth was used only in one concentration, 0.5 gm/l, reducing the rate of pumping by 60%.

It is possible that in the case of chalk the depression of the rate of flow was in part due to the chemical action of that substance. This possibility is now being investigated, and the results will be reported in the final article.

The oysters expelled, in the form of pseudo-feces, large quantities of suspended materials. Nevertheless, some

particles passed through the gills, and some were found in the stomachs and intestines. In other words, although their efficiency of feeding was greatly depressed, the oysters could ingest small quantities of particles even while surrounded by very turbid water. However, some oysters, while kept in heavy concentrations, stopped feeding entirely although their shells remained open and moving. We agree, therefore, with Nelson (4) that oysters can feed in turbid waters, but wish to emphasize the point (not mentioned by him) that an increase in turbidity usually causes a decrease in the rate of pumping and, therefore, feeding.

behavior of oysters in turbid waters, regardless of whether this turbidity was caused by a large number of microorganisms or by inanimate matter.

In our experiments the oysters were kept in turbid water for comparatively short periods, rarely exceeding 6 hrs. Nevertheless, on the basis of our observations we may conclude that oysters are very sensitive to the presence of suspended silt and other substances, and that there is a correlation between the increase in the concentration of such substances and the decrease in the rate of pumping. In strong concentrations oysters may cease pumping entirely.

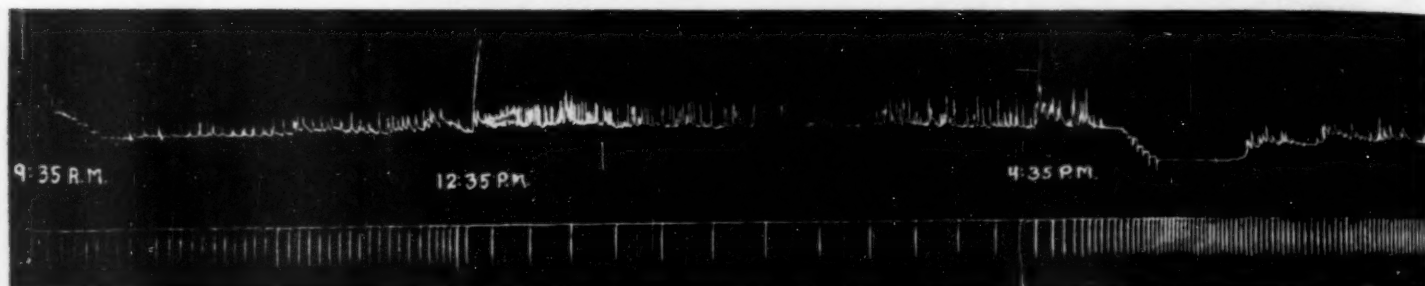


FIG. 2. Section of kymograph record showing effect caused by 2 gm of kaolin/l of sea water upon the shell movement (upper line) and rate of pumping (lower line) of an oyster. Each short vertical mark of the lower line designates emptying of dumping vessel of 275-cc capacity filled with water pumped by the oyster. The oyster remained in turbid water between 12:35 P.M. and 4:35 P.M.

The shell movements of the oysters in turbid water usually became of greater amplitude and their type was different than that observed under normal conditions (Fig. 2). This was especially well demonstrated in stronger concentrations. This type of shell movement was associated with the ejection at frequent intervals of large quantities of material accumulating on the gills. It closely resembled that observed in our experiments, where the oysters were exposed to large quantities of microorganisms (2, 3).

When the flow of turbid water was replaced with regular sea water, the oysters usually quickly recovered. Their shell movement soon became normal, and the pumping increased to the normal rate or even exceeded it. Such a behavior was also noted in our earlier experiments on the feeding of oysters and was usually associated with the change from water rich in microorganisms to normal conditions. In general, the results of our earlier (2, 3) and present studies showed a definite similarity in the

Our studies were made only with Long Island Sound oysters which were accustomed to living in comparatively clear water. We know, however, that in other places oysters live and propagate in water carrying large quantities of silt and clay. Although no explanation for this discrepancy is offered at present, it may be possible that we are dealing with physiologically different races of oysters, some of which have developed a greater tolerance to turbidity. A comparison of the behavior of oysters from widely different ecological environments is the next step in these studies.

References

1. KELLOGG, J. L. *J. Morphol.*, 1915, **26**, 625-701.
2. LOOSANOFF, V. L., and ENGLE, J. B. *Science*, 1947, **105**, 260-261.
3. LOOSANOFF, V. L., and ENGLE, J. B. *U. S. Fish and Wildlife Serv. Bull.*, 1947, **51**, 31-57.
4. NELSON, T. C. *Rep. Dept. Biol. N. J. agric. Coll. exp. Sta.*, 1921, 317-349.
5. YONGE, C. M. *J. Marine biol. Ass.*, 1926, **14**, 295-386.



IN THE LABORATORY

On the Use of the Campbell-Pressman Lyophilizing Apparatus for Urinary Extractives

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In a recent publication, Friedgood, *et al.* (2) described the use of the Campbell-Pressman (1) apparatus for the concentration and preservation of urinary substances by lyophilization. We have used this apparatus with an adaptor and a special flask (Fig. 1) for the evaporation,

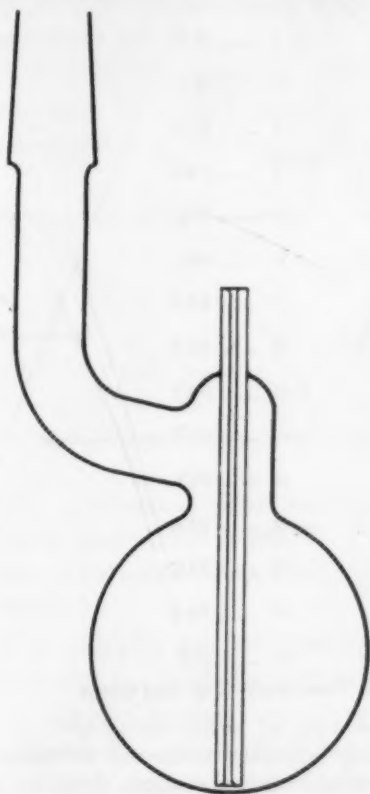


FIG. 1. Diagram of the Claisen-type flask used with the lyophil apparatus. A variety of sizes, ranging in capacity from 250 ml to 1 liter, have been found suitable. This flask is attached to one of the joints of the apparatus by a short, angular adaptor bearing the corresponding ground joint at either end. The adaptor maintains the vertical position of the flask.

at room temperature or below, of urinary extracts, e.g. *n*-butyl alcohol extracts as encountered in the method of Talbot (3). This flask is filled from the neck. Bumping is effectively controlled by admitting a small amount of air (or other gas) through the sealed-in capillary tube, the flow being regulated by means of thermometer tubing

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or other fine capillary attached with rubber tubing to the flask capillary. Further control may be provided by a screw clamp on the rubber tubing. During such evaporation a receiver for distillate is placed on the bottom joint of the apparatus, since liquid may drop down as solid accumulates on the condenser cone.

In the use of the lyophil apparatus with small flasks or tubes to remove organic solvents from mixtures such as those resulting from the acetylation of steroids, we noted a tendency for some light, flaky material to be carried up into the condenser section. To catch this material, we used glass wool, inserted into the mouth of the flask. It is possible that coarse glass cloth on a platinum wire ring would be preferable, since the tuft of glass wool sometimes loosens and is carried over.

We have also found the apparatus useful for the removal of water from the mixture remaining after enzymic hydrolysis of small amounts of steroid glucuronides, preparatory to extraction with organic solvents.

Finally, it should be noted that care must be exercised to remove lubricating grease from the joints before further processing of the sample.

References

1. CAMPBELL, D. H., and PRESSMAN, D. *Science*, 1944, **99**, 285.
2. FRIEDGOOD, H. B., HAAGEN-SMIT, A. J., GARST, J. B., and STEINITZ, L. *Science*, 1947, **105**, 99.
3. TALBOT, N. B., and EITINGON, I. V. *J. biol. Chem.*, 1944, **154**, 605.

In Vivo Geiger-Müller Gamma-Ray Counter for Radioisotope Distribution Studies

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One of the important applications of radioisotopes to biological research is the *in vivo* detection of the distribution of atomic species within an organism with respect to both space and time. This has usually been done by placing an ordinary Geiger-Müller tube on the surface of the organism and observing the counting rate following the administration of a radioisotope. The technique of *in vivo* radioisotope study was apparently first used by Blumgart and Yens (1), and there has followed the development of special counter tubes for the purpose. For

¹ Under Contract N7 ONR-295 with the Office of Naval Research.

² Aided by a grant from the International Cancer Research Foundation.

example, Curtiss (3) has described a very small counter suitable for insertion into tissues; Brown, Good, and Evans (2), a counter for continuous recording of radioactive gas concentrations in expired air; and Strajman (5), a small beta counter for tissue surface measurements.

A compact gamma counting tube and lead shield assembly has been developed in this laboratory which has proved convenient for use with man and the larger experimental animals. The entire unit is shown schematically in

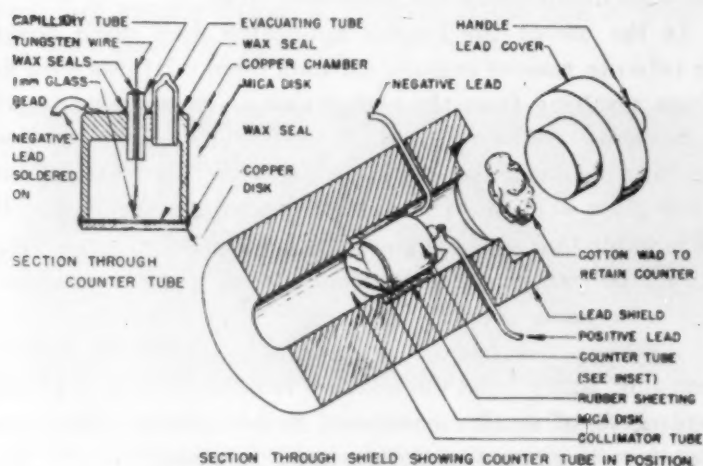


FIG. 1. Schematic assembly of counter tube and shield, with cross section showing tube construction.

Fig. 1, and details of the tube construction are given in the inset. The tube body is made of copper or brass with a $\frac{1}{8}$ " wall which serves as the cathode. The inner diameter of the tube is $\frac{1}{8}$ ", and the inner length is $\frac{3}{4}$ ". The outer length is 1". The central wire, of 3-mil tungsten with a glass bead fused at one end, serves as the anode. A thin, 3-4 mg./cm² sheet of mica is bonded with apiezon wax to the inner surface of the copper disc forming the lower end of the tube, to insulate the disc from the cathode and anode, and the whole is sealed to the tube body with de Khotinsky wax. The copper disc, $\frac{1}{8}$ " thick and 1" in diameter, acts as the counting surface of the tube. The upper end of the tube is drilled in the center to accommodate a short length of glass capillary tubing which is waxed in place and serves to insulate the anode wire. The upper end of the tube is also drilled near the periphery for a piece of ordinary 6-mm pyrex tubing through which the counter is evacuated and filled. The tube, after being pumped down at least overnight at a pressure of 5-10 μ , is tested for leaks and then filled with 1 cm Hg of ethyl alcohol vapor and 9 cm Hg of argon. The tubing is then sealed off as shown in Fig. 1.

Tubes prepared in this fashion have a counting voltage of 1,000-1,100 v, and a plateau 200-400 v long with a slope of 2-3%/100 v. The relative sensitivity of various tubes to a standard source is within $\pm 10\%$. The background, in the lead shield, varies from 5 to 50 counts/min, but is constant for any given tube. The reason for this variation is not clear. It may be due to either a discharge phenomenon or contamination somewhere in the construction. Most of the tubes have a low rather than high background. The life of the tubes has not been de-

termined, but appears to be at least of the order of 10⁶ total counts. The resolving time has been determined to be 1.0-1.5 $\times 10^{-5}$ min.

Generally more satisfactory performance of the tubes has been obtained with the use of a Neher-Harper preamplifier stage rather than with the Neher-Pickering circuit. When the Neher-Harper preamplifier is used, it is necessary to insulate the tube from the lead shield and to ground the latter. Rubber sheeting is wrapped around the counter body, and the tube rests on a fairly thin sheet

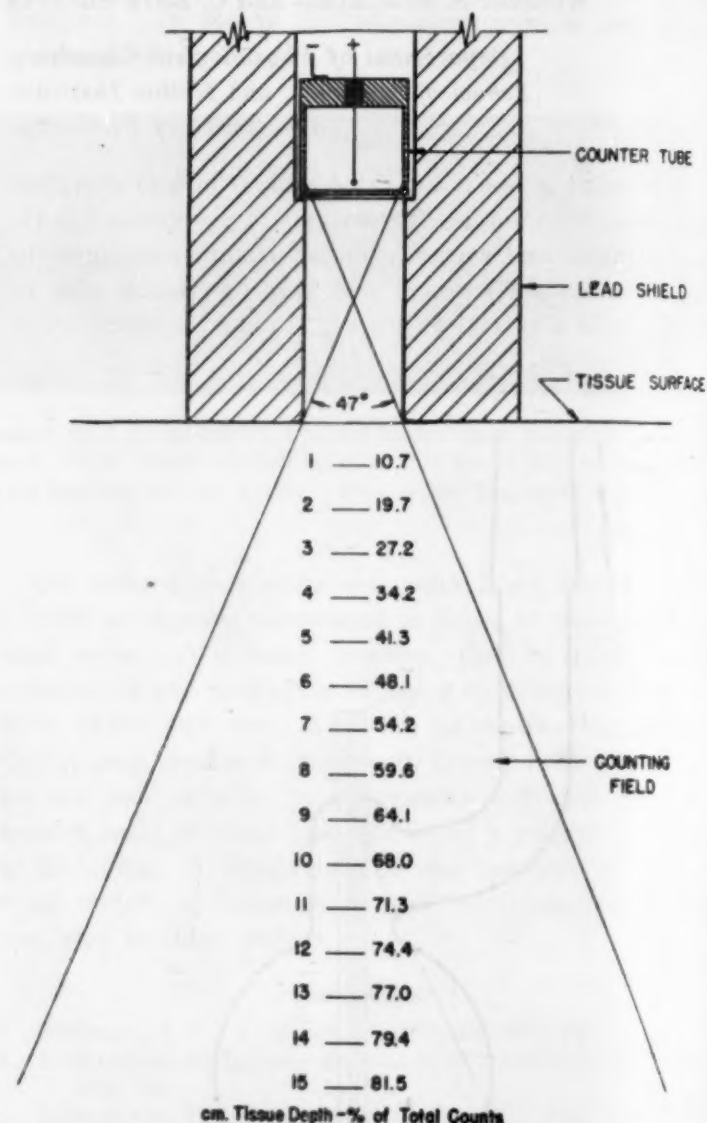


FIG. 2. Cross section of geometrical field of counter tube and shield assembly showing counting efficiency within the field for 0.5 Mev gamma radiation from a homogeneous tissue source.

of mica at the top of the collimator opening in the lead shield. The remainder of the tube space in the lead shield is filled with cotton to prevent motion of the tube inside the shield.

The lead shield was designed so that the counter tube would be surrounded by 1" of lead, except for a collimator opening through which the counting is done. The collimator tube is $\frac{1}{8}$ " in diameter and 2" long. The entire shield is 3 $\frac{1}{8}$ " in diameter and 5 $\frac{1}{2}$ " long. As may be seen from Fig. 2, the counting field comprises a cone with a vertex angle of approximately 47°, and organs such as the heart and liver can be well isolated from surrounding structures by this geometry. On the basis of a theoretic-

cal treatment by Strajman (6) it is possible to calculate the characteristics of the tube geometry with respect to the *in vivo* counting behavior. It may be shown that, as the thickness of a homogeneous source of radioactivity is increased, the counting rate approaches a limiting value. The relationship may be resolved into such factors as the geometry of the counting assembly and the energy and self-absorption, including scattering, of the source. An empirical curve comprising these factors may be constructed which expresses the counting rate at any source thickness as a percentage of the limiting maximal counting rate at infinite thickness. Such a curve was derived for a gamma emitter of 0.5 Mev homogeneously distributed in a medium of specific gravity 1.05, and several values from the curve have been placed at corresponding distances from the tube in Fig. 2. Because of lack of complete data at present, the effect of scattering has been approximated in this case.

The curve has been verified experimentally at several points by counting the activity of various thicknesses of a solution of $K_2C^{11}O_3$. C^{11} is a positron emitter (4) which therefore exhibits an annihilation gamma energy of 0.51 Mev. It is this energy which may be utilized for *in vivo* measurement of C^{11} .

As many as four of the counting assemblies have been used simultaneously to record distribution of a radioisotope in various parts of the body. This has been done

conveniently by placing four mechanical registers in juxtaposition with an electrical timer reading to 0.01 min on a panel and photographing them with an ordinary 35-mm camera at the desired time intervals. Good results have been obtained with CO tagged with C^{11} and with gold colloid tagged with Au^{198} , and it is to be presumed that the performance would be satisfactory with any gamma emitter of relatively low energy. The thickness of the lead shield and the dimensions of the collimator may, of course, be varied to meet individual requirements. It has been found convenient, for measurement of experiment background, to insert a lead plug into the collimator with the counter in position on the body surface, thus taking into account radiation which may penetrate the shield. This has been found to be insignificant with gamma energies of 0.5 Mev, but becomes appreciable with energies greater than 1 Mev.

References

1. BLUMGART, H. L., and YENS, O. C. *J. clin. Invest.*, 1927, **4**, 1.
2. BROWN, S. C., GOOD, W. M., and EVANS, R. D. *Rev. sci. Instr.*, 1945, **16**, 125.
3. CURTISS, L. F. *J. Res. nat. Bur. Stand.*, 1943, **30**, 157.
4. DELSASSO, L. A., WHITE, M. G., BARKAS, W., and CREUTZ, E. C. *Phys. Rev.*, 1940, **58**, 586.
5. STRAJMAN, E. *Rev. sci. Instr.*, 1946, **17**, 232.
6. STRAJMAN, E. Unpublished observations.

Book Reviews

College physics: mechanics, heat and sound. (Pt. 1.) Francis Weston Sears and Mark W. Zemansky. Cambridge, Mass.: Addison-Wesley, 1947. Pp. 383. (Illustrated.) \$3.50.

This text is essentially an abridged version of Sears' *Principles of physics I*. It is the first volume of two, and the purposes of the abridgement are to reduce a two-year course to one year and to eliminate the use of the calculus in the course. Therefore, a number of chapters have been removed, and a number of topics included in the parent volume have either been neglected or treated more briefly; in addition, all elements of the text requiring a knowledge of the calculus have been removed or rewritten using limit or averaging concepts.

The replacement of the calculus by other methods has been done very skillfully and the revision therefore suffers very little in comparison with its model. The presentation of the principles of physics is indeed, for some topics, somewhat improved by the substitution used.

The general scope of the text has not been further restricted, but for the purposes of a review it is important to list the specific, major topics that were either bodily removed or severely curtailed. These are: the concept of the resultant of a set of concurrent forces; non-

uniform acceleration; center of mass and the theorems and problems on the motion of the center of mass; the chapter on work (rewritten; however, it now includes a section on simple machines); the principle of virtual work; the chapter on gravitation (reduced to several paragraphs in the chapter on weight and mass); discussion of the Poisson ratio and the Saint-Venant formula for circular cylinders; Lissajous figures, damped harmonic motion, and resonance phenomena; two-dimensional impacts; the chapter on hydrostatics (somewhat rearranged to give a smoother presentation); surface tension and the Poiseuille formula; discussion of entropy; the chapter on kinetic theory.

Special mention is now made that the reduction of the section on heat has resulted in an improvement of the treatment of the first law. There is now a chapter on the first law and this includes several applications and illustrations previously separated into different chapters. The result is more satisfactory.

The textbook may be classified as excellent and as complete as can be expected for application to a one-year course in college physics.

WILLIAM A. NIERENBERG

Columbia University

Organic analytical reagents. (Vol. II.) Frank J. Welcher. New York: D. Van Nostrand, 1947. Pp. xi + 530. \$8.00.

This is the second volume in a series of four dealing with the use of organic compounds as analytical reagents. The first volume was reviewed in this journal (July 18, 1947, p. 72). The general style and arrangement are the same as in Volume I: the formula, molecular weight, Beilstein reference, properties, and method of preparation are given for each reagent, as well as references to the original literature.

Volume II includes chapters on "The Organic Acids" (89 pp.), "Halogen Substituted Acids" (4 pp.), "Hydroxy Acids" (94 pp.), "Amino Acids" (32 pp.), "Miscellaneous Acids" (10 pp.), "Acyl Halides" (3 pp.), "Acid Anhydrides" (4 pp.), "Esters" (8 pp.), "The Amines" (256 pp.), and "Quaternary Ammonium Compounds" (12 pp.). The book concludes with an index of names and synonyms of the organic analytical reagents treated in the text, and one on their uses, the compounds being listed alphabetically under the element or radical for which they are employed in analytical procedures. The large number of amines used as analytical reagents is indicated by the 256 pages (almost half the volume) comprising the chapter devoted to this type of compound.

The book is conveniently arranged for ready reference and, together with the companion volumes in the set, will make a useful and up-to-date treatise on organic analytical reagents.

JOHN H. YOE

University of Virginia

A concise comparative anatomy. William Henry Atwood. St. Louis: C. V. Mosby, 1947. Pp. 413. (Illustrated.) \$5.50.

Perhaps many victims of the paper blizzard, that modern visitation which silently builds its drifts on doorstep and table, have wearily reflected that the struggle would be easier if words were used qualitatively rather than quantitatively. Prof. Atwood's book is not brief—it has 413 pages bearing 303 illustrations—but it is admirably concise.

Following introductory chapters on such topics as terminology, classification, and embryology, the material is presented on the basis of morphological systems. Each chapter includes both a general discussion of a system and analyses of the system as it is represented in familiar chordates. The histology of many structures is briefly presented. Phylogeny is emphasized. There are numerous summaries, tabular and otherwise. The subject matter is presented in a clear, well-organized, and interesting manner. The illustrations are more than adequate but vary somewhat in quality. The legend (p. 350) for the picture of the human kidney and suprarenal fails to state that the lobulated kidney and relatively large suprarenal gland are not characteristic of the adult.

The text is further supplemented by a glossary, a bibliography of British and American titles, and an in-

dex. The latter is detailed but falls short of the ideal anatomical reference index in which all named structures are listed.

This volume should be of value as an elementary textbook and as a brief reference work.

THOMAS R. FORBES

Yale University

Die genauen Methoden der astronomisch-geographischen Ortsbestimmung. Th. Niethammer. Basel, Switzerland: Verlag Birkhäuser, 1947. Pp. 181. (Illustrated.)

This volume concerns primarily those methods of determining time, latitude, azimuth, and longitude which do not require the precise measurement of a vertical or a horizontal angle. An exception is made in the case of the determination of azimuth, where one method involving the measurement of an angle in the horizontal plane is offered. This approach permits the precise determination of time, longitude, latitude, and azimuth with instruments whose divided circles have not been investigated with great care. Among others, the methods of Pewzow, Doellen, Zinger, and Horrebow-Talcott are presented.

The author is professor of astronomy at the University of Basel and an expert in the field on which he writes. He presents in each case the basic mathematical derivations, including differential expressions which give the errors of the quantities sought in terms of the errors of the observed or given quantities. For each of the principal methods presented, a numerical example is worked out in detail.

Only 6 pages are devoted to the determination of difference of longitudes. There is considerably less on the instruments used than is customary in American books in this field. There are relatively few illustrations. Regrettably, there is no index, but only a table of contents.

This volume will supplement quite well the authoritative American reference volume, *Determination of time, longitude, latitude and azimuth* (5th ed.), Special Publication #14 of the U. S. Coast and Geodetic Survey, Department of Commerce.

CHARLES H. SMILEY

Brown University

Radar system engineering. Louis N. Ridenour. (Ed.) New York-London: McGraw-Hill, 1947. Pp. xviii + 748. (Illustrated.) \$7.50.

This book, the first volume of the MIT Radiation Laboratory series on radar, represents an attempt to present in a coherent manner the information pertinent to the over-all design of a radar system. It is the result of a joint effort by a number of authors under the editorial supervision of Louis N. Ridenour, and the material is drawn from a variety of sources.

Those portions of the book which deal with basic matters are well written and are of permanent value. In these sections, the emphasis is on the "why" rather than on the "how" of system engineering. Material of this type is given in the chapters on the radar equation, prop-

erties of targets, the limitations of pulse radar, and parts of the chapters on C-W radar systems, beacons, and moving target indication. The chapter on targets is enlivened by a set of photographs, reasonably well reproduced, of radar screens depicting mountains, cities, bridges, railroads, coast lines, rivers, and finally, a typhoon complete with an "eye."

A second group of chapters is devoted to material on components and on complete systems to illustrate the application of basic principles. The major part of the book is taken up in this manner, and if the treatment appears to be quite lengthy and even tedious at times, it is no fault of the authors but rather arises from the complexity of radar itself. On any given topic, such as magnetrons and pulsed, the treatment is adequate for the person who wishes a bird's-eye view of the subject but is not detailed enough for the tube or modulator designer. All of the specialized topics such as antennas, receivers, indicators, power supplies, and so on, are handled with the needs of the systems designer in mind, and the specialist will have to wait for fuller descriptions promised in the succeeding 27 volumes in the series.

In the opening chapter the editor takes a quick dip into the early and somewhat controversial history of radar. Not everyone will agree that he is completely objective in characterizing the early work of the Army and Navy as marked by "total failure, and qualified success." Also, the editor could perhaps have improved his treatment of the Radiation Laboratory's 1.25-cm program by giving more fully the background of the troublesome absorption by atmospheric water vapor. How this absorption was calculated, subsequent to the development of equipment, from information in the 1937 tables of the energy levels of water employing known methods in spectroscopy is an intriguing topic, and one of undoubted importance to the systems engineer.

W. D. HERSHBERGER

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Foundations of algebraic geometry. (American Mathematical Society Colloquium Publications, Vol. XXIX.) André Weil. New York: American Mathematical Society, 1946. Pp. xix + 289. \$5.50.

The formulation of the theory of algebraic varieties on a strictly algebraic foundation, begun by van der Waerden and developed in a more advanced sphere by Zariski, is a development of profound significance for algebraic geometry and, indeed, for all mathematics, and the present volume, as the first book on the subject apart from van der Waerden's *Einführung in die algebraische Geometrie*, is an event of great importance. The developments referred to have three main objectives: first, to lay the foundations of the subject on a rigorous basis; secondly, to extend its scope; and thirdly, to provide the researcher with more powerful weapons than he has hitherto had at his disposal. With regard to the first of these, it need only be said that Prof. Weil need fear no criticism from the most pedantic of rigorists. But let us see how the book meets the remaining needs.

The main purpose of the book is to give a rigorous account of the intersection theory of algebraic loci, but in order to do this, the theory of varieties required is developed *ab initio*. Varieties are defined over any ground field, but Weil's definition includes two major restrictions: the varieties are required to be absolutely irreducible, and their function fields are assumed to be separable extensions of a pure transcendental field. These restrictions are, of course, entirely acceptable to classical geometers who take the field of complex numbers as ground field, but some modern writers have dealt with varieties not satisfying these restrictions. Nevertheless, this volume carries the subject further in the field which it covers than has ever been done before for such a wide choice of ground field. On the other hand, the provision of a variety of methods is not the object of the book, and though it demonstrates the ample power of the methods employed, which may be new to many, certain of the tools used by others, notably valuation theory, are entirely excluded. This is quite allowable in a book whose object is to expound a theory and not to describe methods, but certain views are expressed on other methods on which opinions may differ; in particular, the reviewer disagrees with the author in his opinion of the usefulness of elimination theory.

The book will be of immediate and absorbing interest to those who are already following the modern developments in algebraic geometry. A complete and rigorous account of intersection theory, established with the generality which Weil allows himself, is in itself a great achievement, but the careful reader will find much in the detail which will prove of great value in other branches of algebraic geometry. After a preliminary chapter establishing some general theorems on field extensions, there are two chapters devoted to Specialization (van der Waerden's *Relationstreuespezialisierung*) in which will be found a large number of new results which greatly add to our understanding of this concept. In the fourth chapter the concept of an algebraic variety is introduced, and the main properties of join, intersection, and algebraic correspondence are developed. Then follow two chapters which deal exhaustively with the ideas of intersection multiplicity, the central theme of the whole book; the work in this is without doubt destined to be the authoritative version of this subject for years to come. In these chapters the variety is regarded as in affine space, and the next chapter has the effect of extending the theory to projective space. This is not, however, done in the usual way; rather, borrowing from topology the idea of defining a manifold by overlapping neighborhoods, he considers the variety in projective space as defined by the aggregate of varieties in affine space which can be derived from it by different choices of the hyperplane at infinity. The book concludes with a chapter on functions and divisors, and a most stimulating chapter entitled "Comments and Discussions," to which many will have frequent recourse for inspiration.

On the other hand, the nonexpert—even the geometer who has remained completely loyal to the classical tradition—will undoubtedly find the book a puzzling one, for

the book makes no concessions to weakness. Other accounts of the modern work on algebraic geometry at least begin by considering something which looks familiar; varieties are defined by a system of equations, and the only generalization on classical theory is that the coefficients are chosen from a general field instead of as complex numbers. Not so with this book. Here the whole subject is conceived of as a development of the theory of fields, and the geometry appears only as an interpretation; indeed, the chapter in which geometrical ideas are first introduced is significantly entitled "The Geometric Language." Because of the austere form in which the subject is presented and because the presentation is extremely condensed, theorem following theorem in a seemingly endless procession, it is to be feared that many useful recruits to this kind of geometry will be frightened off rather than attracted.

Indeed, the expert will not find it easy going and may easily miss much of value on a first reading. But, if he keeps returning to it, he will realize more and more how much of importance, not only for the purposes of the volume but for wider applications, is crowded into brief statements and proofs. As readers become more and more familiar with the work, it will come to be recognized for what it is—one of the real landmarks in the literature of algebraic geometry.

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Probit analysis: a statistical treatment of the sigmoid response curve. D. J. Finney. Cambridge, Engl.: at the Univ. Press; New York: Macmillan, 1947. Pp. xiii + 256. \$3.75.

This little book draws together developments of recent years in the dosage-mortality field, including the author's own important contributions. The format is clear and attractive.

Beginning with definition of biological assay, all-or-none and graded responses, the treatment discusses frequency distribution of tolerance (or susceptibility) among individuals of a biological population. The approximate "normalization" following transformation of concentration values to logarithms, and the binomial distribution of percentages responding, are taken up next. The change of percentages of population affected to *probits* or standard deviation values brings a normal curve into linear form. From regression thus simplified, the concentration (ED_{50}) required to affect 50%, or some other proportion of the population, can be estimated. Materials can thus readily be compared as to potency. Other past and present methods, with history of dosage-effect studies since Fechner, are touched upon.

Mathematical treatment of weighting, estimation, comparison, and tests of significance is outlined. The maximum likelihood solution, giving some gain in efficiency, is described. Adjustments for natural mortality, with approximate and exact solutions, are discussed. Under "factorial experiments" the author takes up multiple-

regression analysis with two or more introduced causes of variation, such as exposure time and concentration of poisons. A valuable chapter on joint action of mixtures is included, with tests for similar action and synergism. Miscellaneous problems are discussed, especially Parker-Rhodes' suggestion of using a fractional power of dosage, which may give normality in some cases. The text closes with notes on possibility of applications to some cases of graded response. Appendices include convenient computational methods, technical discussion of derivations, a bibliography, and statistical tables.

The discussions are well illustrated throughout with arithmetic calculations. Rapid graphic solutions, and design of experiments, are touched upon but not elaborated. The frequent failure to secure complete linearity or normality is also touched upon; it does not invalidate the methods outlined. The mathematical bases of methods are well presented. On the whole, the book is an extremely useful source of information.

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Scientific Book Register

HAYNES, B. C. *Techniques of observing the weather.* New York: John Wiley; London: Chapman & Hall, 1947. Pp. xvi + 272. (Illustrated.) \$4.00.

HUBBS, CARL L., and LAGLER, KARL F. *Fishes of the Great Lakes region.* Bloomfield Hills, Mich.: Cranbrook Institute of Science, 1947. Pp. xi + 184. (Illustrated.)

KARRER, PAUL. *Organic chemistry.* (3rd Engl. ed., trans. by A. J. Mee.) New York-Amsterdam-London-Brussels: Elsevier, 1947. Pp. xx + 957. \$8.50.

KIRK, RAYMOND E., and OTHMER, DONALD F. (Eds.) *Encyclopedia of chemical technology.* (Vol. 1, A to Anthrimides.) New York: Interscience, 1947. Pp. xxiv + 982. (Illustrated.) \$20.00.

LOW, R. CRANSTON, and DODDS, T. C. *Atlas of bacteriology.* Baltimore: Williams and Wilkins, 1947. Pp. vii + 168 plates. \$8.50.

ODGERS, MERLE M. *Alexander Dallas Bache: scientist and educator, 1806-1867.* Philadelphia: Univ. Pennsylvania Press, 1947. Pp. vii + 223. \$2.75.

ROBERTS, ARTHUR. (Ed.) *Rader beacons.* (Massachusetts Institute of Technology Radiation Laboratory Series.) New York-London: McGraw-Hill, 1947. Pp. xx + 489. (Illustrated.) \$6.00.

SWANTON, JOHN R. *The Wineland voyages.* (Smithsonian Miscellaneous Collections, Vol. 107, No. 12, Publ. 3906.) Washington, D. C.: Smithsonian Institution, 1947. Pp. 81. \$50.

WHITTAKER, ROLAND M. *Rudiments of chemistry: the chemist's view of the nature of matter.* New York: Ronald, 1947. Pp. x + 310. (Illustrated.) \$3.00.